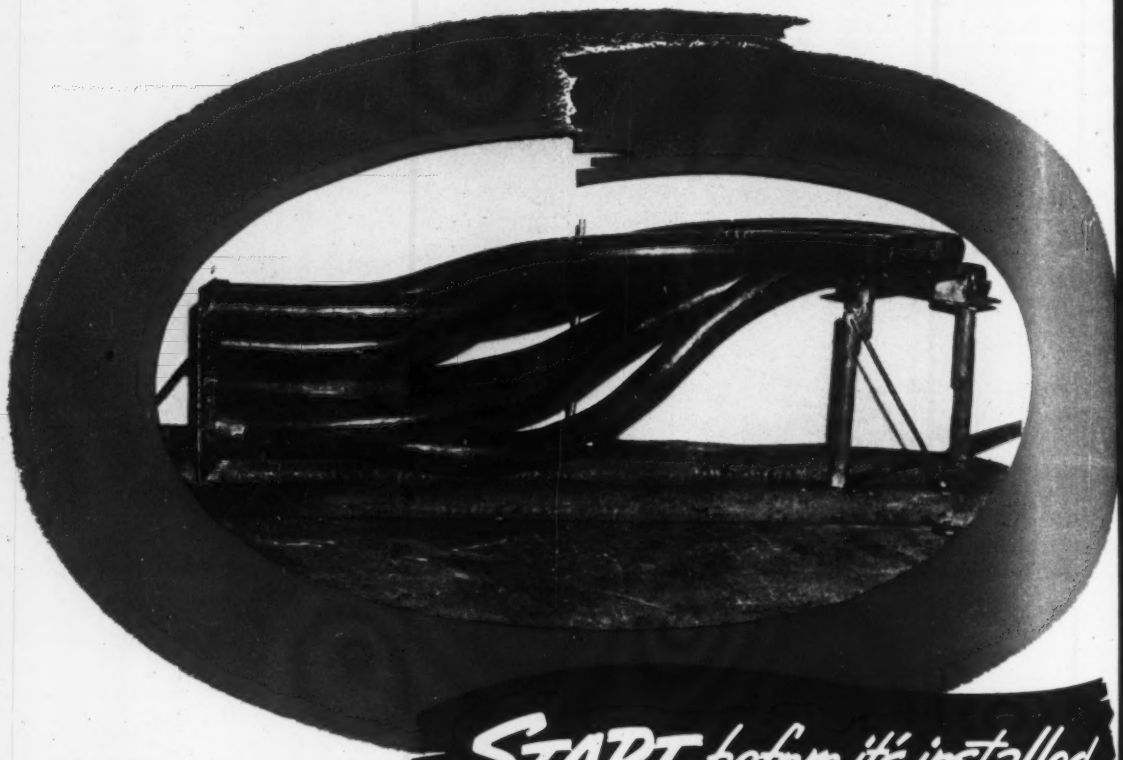
This Issue: ENGINEERS FIGHT RECORD FLOODS

THE ADVANTAGES OF
Byers Wrought Iron Conduit



START before it's installed

This nest of heavy-wall conduit was designed to carry cables into one of the exchange buildings of the Bell Telephone System. The material is Byers Wrought Iron, fabricated by the Flori Pipe Company, St. Louis, Mo.

The corrosion resistance of Byers Wrought Iron is generally the primary reason for its use . . . but this installation illustrates a valuable added advantage. Considerable forming is often necessary in installing conduit, and the excellent bending qualities of Byers Wrought Iron facilitate the job and assure satisfactory results.

Because of the emphasis on uninterrupted service, telephone companies were among the first to recognize the durability of wrought iron in conduit work, and have used it in many difficult applications. In a river crossing at Green Bay, Wisconsin, a bank of 12 conduits, pre-shaped to the contour of the river bottom, were used. A five-day, 80-pound air test failed to reveal a single leak. At another location, the runs of wrought iron conduit were pulled across the channel, through a trench dredged in the river bottom. Here again a pressure test showed no leaks.

Power companies, municipalities, and railroads are equally large users of wrought iron conduit. Power cables, traffic light systems, and signal systems, underground, under water, and in bridge crossings, are regularly safeguarded by it. The unusual structure of wrought iron . . . tiny fibers of "iron-glass" threaded through a matrix of high-purity iron . . . resists both corrosion and fatigue-producing vibration. The fibers halt and deflect corrosive attack, as well as anchoring the initial protective film which shields th underlying metal. They also give "hickory-like" character to th material, which accounts for i resistance to fatigue failure fro shock and repeated stresses.

Any time that a problem ans involving material selection heavy-wall conduit, our Enginee ing Service Department will b glad to give you some records wrought iron's performance as guide in specification. Just writ

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CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

Continental U.S. Construction 50% Below '43

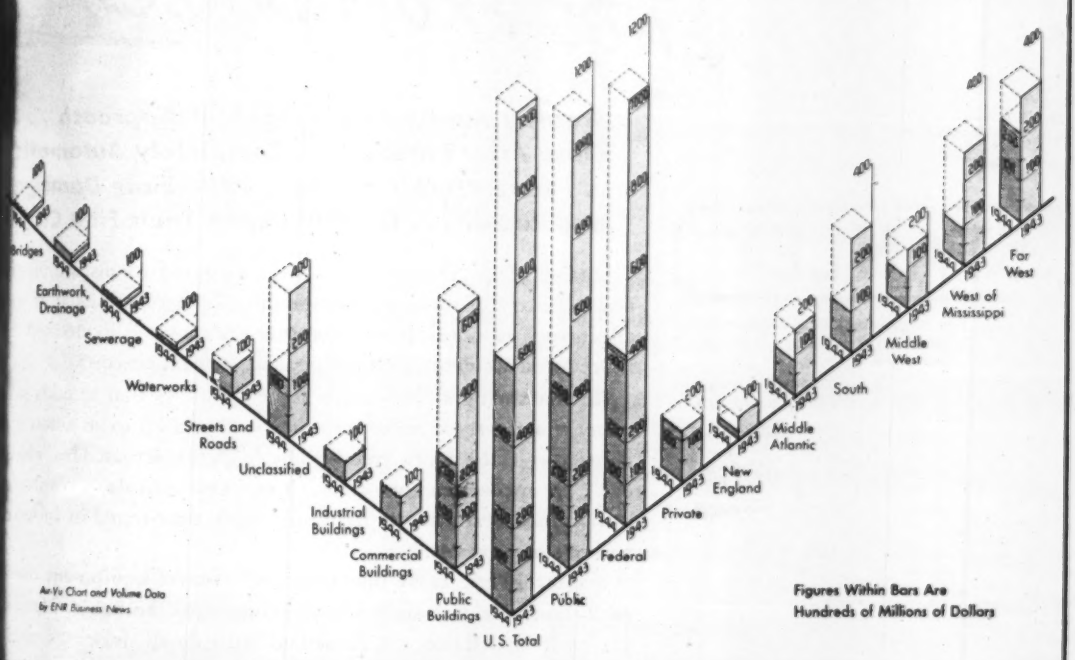
CIVIL ENGINEERING construction reported to *Engineering News-Record* totals $595,162,000 for the opening four months of 1944, a volume 51 percent under the $1,218,109,000 for the corresponding period in 1943. Both private work, $125,989,000, and public construction, $469,173,000, are lower than in the 1943 period. Private declines 1 percent, and public is 57 percent lower as a result of the 4 percent decrease in state and municipal and the 60 percent drop in federal volume. Industrial building volume, $46,829,000, tops the 1943 four-month total by 5 percent, and earthwork and drainage volume, $19,995,000, is 75 percent above a year ago. All other classes of work are below their last year's totals. Waterworks construction declines 1 percent; sewerage, 41 percent; bridges, 60 percent; streets and roads, 30 percent; public buildings, 60 percent; commercial building and large-scale private housing, 4 percent; and unclassified construction, 59 percent.

Geographically, all sections of the nation report decreases when compared with their four-month 1943 volumes. The New England total, $17,053,000, is down 68 percent; Middle Atlantic, $88,508,000, is 47 percent lower; South, $99,325,000, declines 64 percent; Middle West, $74,048,000, is off 47 percent; West of the Mississippi, $91,538,000, is 67 percent lower, and Far West, $224,690,000, is down 26 percent.

These *ENR*-reported volumes do not include the construction by military engineers abroad, American contracts outside the country, or shipbuilding.

ENR—REPORTED ENGINEERING CONSTRUCTION VOLUME

(Comparison of Opening Four-Month Totals, 1943 and 1944)



An Ye Chart and Volume Data by ENR Business News

Figures Within Bars Are Hundreds of Millions of Dollars

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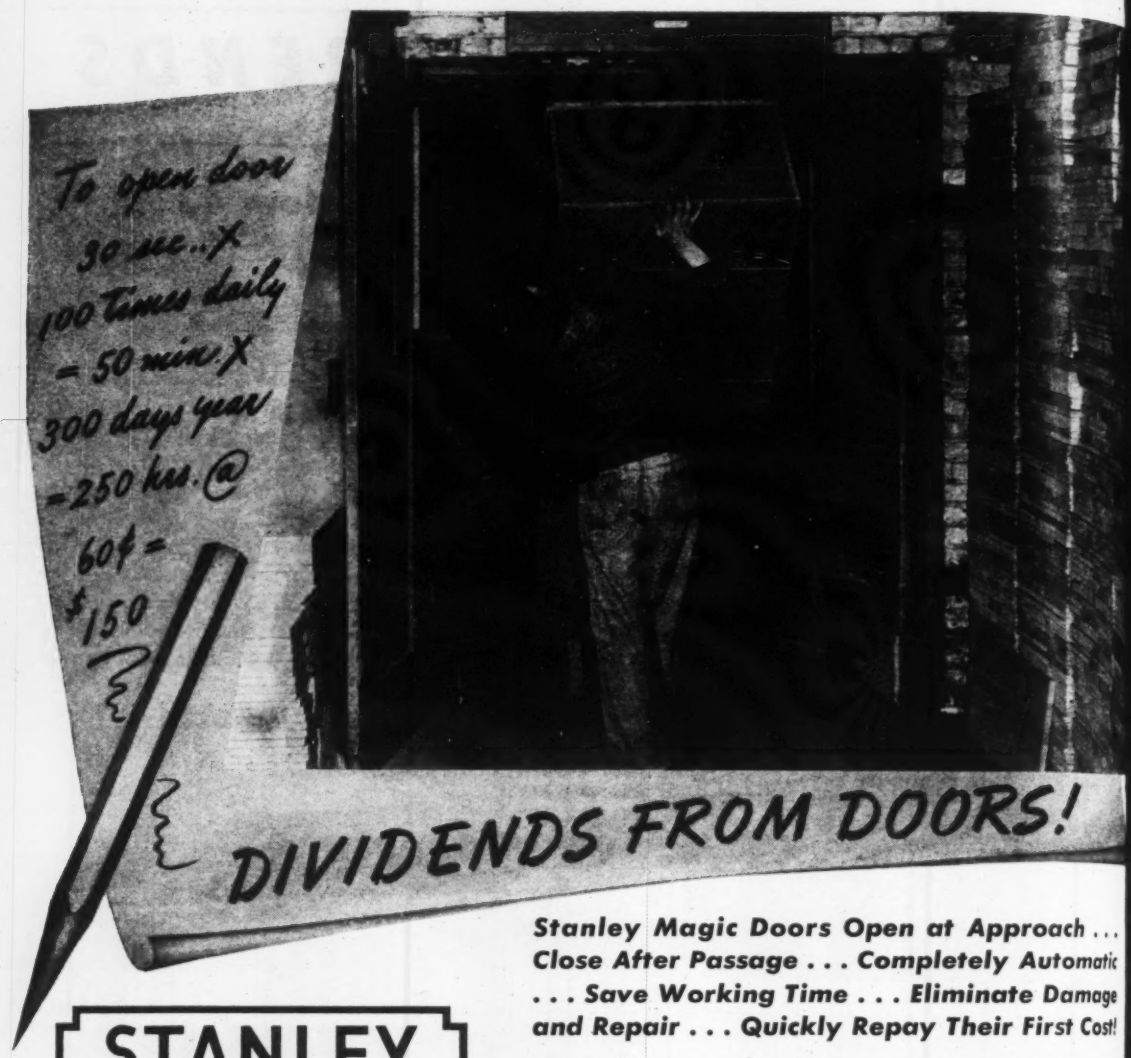

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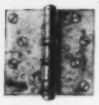

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

132 May 18, 1944 No. 20

...MING NEXT

...at's Ahead for Waterworks? ...authoritative answer to this ...ion is given in the June 1, issue ...rthur E. Gorman, director of ... utilities of the War Produc... Board, who discusses the out... for materials, equipment and ...ower. Also in this issue for ...works men; An *ENR* appraisal ...stwar prospects for construc... an informal report by E. L. ..., based on a 45,000-mile visit ... coast to coast; and an article ...e revamping of the Jackson, ... treatment plant.

...o scheduled for the June 1, ...is H. W. Richardson's story on ...NG WITH SKYHOOKS—which ...ibes construction problems in ...ing a series of coast defense ...ns along the rugged peaks of ...laskan mountains. D. B. Stein... national known consulting engi... contributes his second article ...GRAPHIC METHODS FOR ENGI..., with particular emphasis on ...ent distribution of linked rig...

...OKING AHEAD

..."Fighting Tundra"—might well ...e title of a forthcoming article ...H. W. Richardson, *ENR* Western ...r, on roadbuilding and airport ...truction in the Aleutian Is... Tundra is a swampy, vegetal ... that literally blankets these bar... treeless islands. How to build ...s roads, and more access roads, ...hurry over this type of terrain ...the major problem of our Army ...eers. The problem was solved, ...in the process a new and inter... roadbuilding technique was ...oped.

... new type of bascule bridge de... for skewed crossings will be ...ribed in an early issue. The for... portions of the main girders are ...llel to the centerline of the road... while the rearward portions, ... carry the underfloor counter..., are at right angles to the ...rline of the stream, rigid-knee ... at an obtuse angle connecting ...rward and rearward portions of ...girders. Many advantages are ...ed from this type of design ...ment.

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POST-WAR HIGHWAYS CAN BE MAD HIGHLY SCALE-RESISTANT

with ATLAS DURAPLASTIC* air-entraining portland cement

More than 60 installations—some with five years of service—i dozen different states prove value of Universal Atlas developme

Lawrence Street, Appleton, Wisconsin, photographed after three winters of salt de-icing treatm Left lane, laid with normal portland cement, shows considerable scaling. Right lane, laid at sa time with Atlas Duraplastic, is practically scale-free.

DURAPLASTIC was announced after years of research and tests by Universal Atlas in the laboratory, in the manufacture of this cement and in the field. It is a true portland cement in which is interground during manufacture the precise amount of air-entraining material required for proper field performance.

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When planning your post-w streets and highways, write to o Technical Service Bureau for furth information on Atlas Duraplast Ask for reprints of technical artic on street and highway installati and on the original research.

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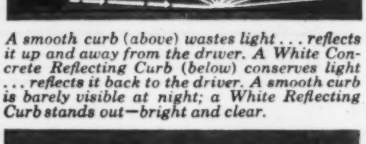
REFLECTING CURB MAKES NIGHT DRIVING SAFER

Highways in a dozen different states protected by Concrete Reflecting Curb made with Atlas White cement

Combining the functions of a reflector with the functions of a curb, Concrete Reflecting Curb made with Atlas White cement has demonstrated its contribution to safer highways in scores of installations in a dozen different states.

The diagrams below show how the sawtooth faces of this curb reflect the car's own lights *in the right direction*—back to the driver's eyes. This makes the curb stand out clearly and sharply. A smooth curb, even though white, reflects light away from the driver, and therefore is barely visible. When rainy nights turn road and curb into watery mirrors, this reflective advantage is made even greater. Smooth curb is practically invisible, but White Concrete Reflecting Curb shines out as a white guide to safety clearly marking the road's edge.

For detailed information, write to our Atlas White Bureau. Ask for a copy of the book, "A White Guide to Safety."



A smooth curb (above) wastes light . . . reflects it up and away from the driver. A White Concrete Reflecting Curb (below) conserves light . . . reflects it back to the driver. A smooth curb is barely visible at night; a White Reflecting Curb stands out—bright and clear.

ENR-DC-3

UNIVERSAL ATLAS CEMENTS

UNIVERSAL PORTLAND • ATLAS PORTLAND • ATLAS WHITE • ATLAS DURAPLASTIC • ATLAS HIGH-EAR

The Week In Engineering and Construction

INEERING NEWS-RECORD • MAY 18, 1944 • VOLUME 132 • NUMBER 20

ig postwar river program pproved by the House

ostwar flood-control work and multiple-purpose servoir construction totaling $810,000,000 authorized bill sent to the Senate for approval.

e House of Representatives has d the War Department's flood-con- bill, and sent it to the Senate, it is awaiting recommendation e Commerce Committee. The bill rizes expenditure of $810,000,000 onstruction of flood-control and le-purpose projects in 28 river scattered throughout the coun-

projects all are authorized for uction after the war unless ma- , equipment, and manpower make an earlier start possible. specifications, and preliminary however, can be carried on dur- e war with funds from appropria- already made or yet to be made od control.

additional $1,500,000 is author- for surveys by the Federal Power nission in connection with projects ded for in the bill; and $10,000,- more is made available for ex- ture in equal amounts by the War rtment and the Department of ulture for surveys for additional control, watershed investigations, and waterflow retardation and rosion prevention in Florida, Ohio. York, Minnesota, Illinois, Indiana. s, Oklahoma, South Dakota, rnia, and Puerto Rico.

ne of the projects are new, while have already been authorized in but require authorization of addi- funds. Projects listed for the Mississippi River and the Mis- River basins total $200,000,000 ch basin.

vision is made in regard to the uri River basin that nothing in t "shall be construed as creating Sioux City any demand upon ater resources of the Missouri basin above Sioux City in excess at now authorized by law." A r provision was put into the and harbors bill when it was considered by the House, in an effort to appease consumptive water users in the upper states. That bill also is now before the Senate Commerce Committee.

The flood-control bill also provides that some of the storage reservoirs authorized for the main stem of the Missouri may be constructed on tributaries, in the interest of silt control and making water available for agriculture and industry.

Improvement works for runoff and waterflow retardation and erosion prevention, aggregating $65,000,000 also are authorized, for construction by the Department of Agriculture, in seven watersheds and river basins.

Multiple-purpose projects

The bill makes it the duty of the Secretary of War to prescribe regulations concerning storage available for flood control or navigation at reservoirs built either by the War Department or the Bureau of Reclamation. The bureau approves of this provision. It is willing to release water from its reservoirs to provide space to store water for flood control.

The bureau, however, does not approve the proposal that the Secretary of the Interior prescribe regulations, under existing reclamation laws, for use of water for reclamation purposes which is stored in War Department reservoirs. The bureau wants the additional assurance that it will have the right to control use of water farther down stream. It proposes to submit amendments covering these matters.

The Bureau of Reclamation also takes exception to construction by the War Department of two multiple-purpose projects in California; a $19,700,000 project for Kings River basin, and one for $6,800,000 on the Kern River in the San Joaquin valley. A project has already been authorized for construction on the Kings River by the bureau, which feels that both this and the Kern River project should be closely coordinated with its Central Valley project.

The bill gives the War Department blanket authority to sell surplus water from its flood-control projects to states, municipalities, private concerns, or individuals, for domestic and industrial use, at prices to be determined by the Secretary of War. It also gives overall jurisdiction to the War Department to construct and operate park and recreational facilities in its various reservoir areas, and authorizes it to permit such construction by other agencies.

Clarifying provisions definitely state that major drainage improvements can be included as a part of flood-control construction, and extends the provision establishing local cooperation requirements to apply to this act.

Emergency bill passed by House

The House on May 15 passed an emergency flood control bill, introduced by Representative Whittington of Mississippi, authorizing 12 million dollars for use by the Corps of Engineers for the repair, restoration, and strengthening of levees and other flood control works threatened or destroyed by recent floods, and for completion of similar work begun in 1943.

The bill has now gone to the Senate, where a similar bill introduced by Senator Lucas of Illinois in the amount of 10 million dollars is pending in committee.

. . .

Cross-connection survey planned for Washington

William E. Holy, senior assistant sanitary engineer, has been assigned by the United States Public Health Service to the Bureau of Sanitation of the District of Columbia Health Department to make a study of the city's water supply. Working under Maj. William H. Cary, director of the Bureau of Sanitation. Mr. Holy will devote his attention to cross connections. A preliminary survey showed some "faulty conditions," and the new studies are to be made in order to avoid a potential danger to the city's water supply.

The cross connections to be studied include those where two types of water are piped into the same building, such as city drinking water and water from another source for air conditioning.

More asphalt available for roads and streets

Increased use of asphalt in highway maintenance and repair is expected during 1944, for no limitations will be placed on the movement of asphalt, and the states may schedule any such work as comes within the limits set by WPB Order L-41-E (*ENR* April 27, p. 631). During 1943, asphalt could only be moved under a permit system set up by the Public Roads Administration. This year, the governors of all the states have been urged by Col. J. Monroe Johnson, director of the Office of Defense Transportation, to eliminate "every possible delay" to asphalt-carrying tank cars and tank trucks, and state highway officials have been requested to speed up testing processes so that shipments will not be held up pending certification.

In connection with this, Colonel Johnson suggests the following three methods for streamlining testing procedures: (1) Stationing of state inspectors at the refineries for on-the-spot testing of asphalt; (2) state acceptance of reports of commercial testing laboratories and certified tests of refineries; and (3) dispatching of samples by express to state laboratories before shipment by tank car or truck.

Tank cars are assigned in accordance with a War Production Board priority list that places paving materials below other commodities required by military and civilian programs.

• • •

Gen. D. A. Davison dies en route from overseas

Brig. Gen. Donald A. Davison, 51, head of the Provisional Engineering Command in the Mediterranean War Theater, died May 6 in a hospital in Bagalore, India, while en route to the United States.

Born in San Carlos, Ariz., General Davison was graduated from West Point in 1915 nineteenth in a class of 164. During and following the first world war he had assignments as instructor in the various army schools and in 1924 was assigned to a three year tour of duty with the 11th Engineers in the Panama Canal Zone. His next assignment was as assistant to the Engineer Commissioner for the District of Columbia, followed by a term as district engineer at Louisville, Ky. Later he was commanding officer of the 21st Engineers.

He was assigned to permanent station in London, England, on February 24, 1942. He was also assigned, at a later date, as Chief of Staff, Headquarters Services of Supply, United States Army Forces in the British Isles. Later he was assigned to duty as Chief of Staff, Headquarters, Army Air Forces in the North African Theater of Operations. He was promoted to brigadier general, temporary, April 16, 1942.

Having served as engineer of the Allied Air Forces at Air Force Headquarters in North Africa, on March 12, 1943, he was assigned to the duties of Air Engineer of the 12th Air Force (Advanced), and in November, 1943, to additional duty as engineer, 15th Air Force. In May, 1943, he reported to the Office of the Air Engineer, Washington, D. C., and elsewhere in the United States for temporary duty, then returned overseas. He was permanently promoted, in the corps of engineers, to the grade of colonel, June 12, 1943.

In June, 1943, Brig. Gen. Davison was awarded the Legion of Merit for exceptionally meritorious conduct in the performance of outstanding service.

In February, 1944, he was reassigned to the Army Air Forces Engineer Command, Mediterranean Theater of Operations, and became commanding general of that organization.

• • •

McTigue, new director WPB's Facilities Bureau

John B. McTigue, formerly deputy director of the Construction Division of the War Production Board, has been promoted from deputy director to director of WPB's Facilities Bureau, which processes all applications for construction, and also was made vice-chairman of the Facilities Committee, which makes recommendations to the bureau. He succeeds Roy W. Johnson, who resigned to take an executive position with the Warren Telechron Clock Co., Ashland, Mass.

Mr. McTigue is a graduate civil engineer from Princeton University. During the last war he served as a lieutenant in the Civil Engineer Corps, U. S. Navy. He was later associated with the firm of Voorhees, Gmelin and Walker, architects and engineers of New York, and has also conducted a business of his own in the real estate and building field.

Mr. McTigue is succeeded as deputy director of the Facilities Bureau by Richard A. Kimball, who since January, 1942, has served WPB in the Construction Division, and as special assistant to the director of the Facilities Bureau, of the Board.

Gen. Worsham becom Asst. Chief of Engine

Brig. Gen. L. D. Worsham, com der of the Northwest Service Com has been appointed assistant Ch Engineers in charge of troops, headquarters at Washington, to su Gen. Clarence L. Sturdevant, who be given another assignment in near future.

General Worsham has been a monton, Alta., since April, 1943, su vising the work of the Army Engi in the construction of the Alaska H way and the Canol oil project. Ge Worsham once served as Acting Div Engineer of the Ohio River Div U. S. Engineers, next serving as Di Engineer at Mobile, Ala. He wi succeeded at Edmonton by Col. Strong.

General Sturdevant went to Wa ton in 1940 from Kansas City, where he had been division engine the Missouri River Division.

• • •

U. S. signs new agreem on Niagara diversion

President Roosevelt has asked Senate to approve an agreement the Canadian government by w Canada would divert an addi 4,000 cu.ft. of water per secon the Canadian side of the Niagara for the generation of an addi 620,000 kw.-hr. of electric energy day. Most of the power would made available, under existing arr ments, for utilization in the U States.

The request for diversion was m by Canada "In view of the contin need for additional power in Niagara Falls area for war purpo The agreement is to continue in e until the end of the war, unless minated earlier by agreement.

It is also agreed that engineers o two countries shall "take all fea steps" to minimize the effect of further diversion upon the s beauty of Niagara Falls.

Agreement was reached in n dated May 3, exchanged between L ton McCarthy, Canadian Ambassa Washington, and Secretary of S Cordell Hull.

In announcing the agreement in Canadian House of Commons, Ju Minister St. Laurent said that th version works recently complete the Hydro Electric Power Comm of Ontario above the Horseshoe had been more effective than exp both in adding to the efficiency of power development and in preser and improving the fall's scenic be

...tle surplus construction equipment ...pected at the end of hostilities

...ly of construction equipment in Army Engineer depots here ...be low—Procurement Division of the Treasury to sell equip... only through authorized dealers.

...ll be possible to utilize all avail... ...nstruction equipment on useful ... after the war with Germany, ... Philip B. Fleming, Adminis... of the Federal Works Agency, ...embers of the Manufacturers ... of the American Road Build... ...sociation. This statement was ...t a conference held in Washing... ...ay 10, which was devoted to ...ions on disposal of war surplus ...ction equipment. Charles M. ..., engineer director of the A.R. ...n opening the meeting, stressed ...portance of the subject to the ...highway industry.

...ral Fleming said he had "been ... that construction machinery ... will fall into the surplus cate... ...s soon as Germany is beaten ...ount to a normal year's produc... He then added that "there is the ...lity of using all of the equipment ... get our hands on—and much ...esides—in the building of useful ..., private and public.

...e are to reach a national income ...0,000,000,000 after the war— ...is the figure generally stated to ...ential to national well-being—it ...seem that construction activities ... account for . . . from $14,000,... ... to $18,000,000,000 in both ... and public work," he said.

...added that of $60,000,000 in ... funds available to state highway ...ents for planning, however, only ... over $13,000,000 has been util... Sixty millon dollars, he said, is ...t to "generate a program of ...000,000," but added that "It is ...nable, however, whether a pro... ...f that magnitude will be ready ..."

...,000 pieces reconditioned

... Gen. Theron D. Weaver, direc... Industrial Demobilization, Army ... Forces, gave figures on the ... of construction equipment in ...nds of the Corps of Engineers. ...ps, he said, does not have much ... in the more critical types of ...ction equipment. Of 100,000 ...eld early in 1943, which were ...ed to be worth $220,000,000— ...g dump trucks, and equipment ... Alaska Highway—over 80,000 ... have since been reconditioned and redistributed. Most of these are now in the hands of troops.

A recently completed analysis of the above survey indicated that 85,000 items of the 100,000 were in this country, and 15,000 overseas. Of the number in this country, only 19,185 pieces, valued at $132,000,000, were of the heavy types now greatly in demand, such as asphalt plants, motor and elevator graders, rollers, crawlers, and cranes.

About 16,000 of these 19,185 pieces have since been reconditioned for use overseas, leaving little over 3,000 still in use by the corps in the United States. Since about half of this number will be needed permanently, the general said, only about 1,500 are still available to be reconditioned and put to use overseas.

Recent studies indicate that Army requirements for certain types of construction equipment after the warfare in Europe ceases may be 40 percent below present requirements. As an immediate means of reducing requirements, General Weaver said, the Army is now using a method of figuring needs, whereby procurement will be more closely integrated with actual use.

Approximately $5,000,000 worth of construction equipment is now being processed by the Army engineers for reporting as surplus to the Treasury Procurement Division. This includes little heavy equipment such as highway machinery; it is made up largely of lighter pieces, such as vibrators and pumps.

The War Department is soon to require a monthly report from the field installations in this country showing the utilization of existing equipment, and what may be considered as surplus. The department will then determine whether the surplus shall be rehabilitated and sent to troops overseas, or be turned over to Treasury Procurement for disposal. Surplus parts also will be reported.

Information concerning policies for disposal of surpluses was given at the conference by W. L. Clayton, Surplus War Property administrator. He told members his administration was recently given authority to formulate policies for disposal of contract termination property, including construction equipment, as well as equipment already in the hands of the government.

He said he hopes much of the construction equipment, which will be available upon termination of contracts for manufacturing it, can be sold during the 60 days between the manufacturer's inventory report and the date upon which the manufacturer turns the property over to the government. After that, no further sales can be made until the agency receiving the equipment declares it surplus.

OPA price ceilings to apply

Pricing of all construction equipment will involve adherence to ceilings set by the Office of Price Administration, and may necessitate appraisal. Sale may be by negotiated contract, auction, or by competitive sealed bids. The present plan is that federal agencies will be given 21 days in which to buy, before equipment is offered for sale to manufacturers or dealers, through whom all remaining equipment will be sold. Tax-supported agencies probably will be given first chance to buy from dealers. No equipment will be given away unless the Congress so directs.

It is expected that equipment both in this country and abroad will be disposed of as nearly on the spot as possible, and that the United Nations Relief and Rehabilitation Administration will be a large buyer.

C. E. Mack, director of the Treasury Procurement Division; and Ernest L. Olrich, recently appointed special assistant to the Secretary of the Treasury, and assigned to surplus disposal problems, further outlined methods by which equipment is to be handled.

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Province of Quebec enters power business

The province of Quebec went into the power business when it set up the Hydro-Electric Commission and took over the Montreal Light, Heat and Power Consolidated under an act of the provincial legislature authorizing expropriation of the power company's properties, which include the great Beauharnois hydro plant on the St. Lawrence River above Montreal.

Two members of the five-man Hydro-Electric Commission are engineers. They are J. W. McCammon and R. A. Latreille. Mr. McCammon is a graduate of McGill University in 1912. He served as assistant general manager on the Beauharnois Development from 1929 to 1934. Mr. Latreille is a civil engineer and a graduate of the Ecole Polytechnique in 1922.

Construction Communiques

Engineering News from the Battlefronts

Ascension Island—"U. S. Army Engineers have seldom taken on a more difficult assignment than their work on this 6 x 9-mi. volcanic island in the middle of the South Atlantic on the plane transport route from Brazil to Africa," says Lieut. Col. Frederick J. Clark, former commanding officer of the 1st Battalion, 38th Engineering Combat Regiment. This is in his fascinating illustrated article entitled, "Ascension Island, an Engineering Victory," which appeared in the May issue of the "National Geographic Magazine."

The mission of his group in 1942 was to construct an airfield on this volcanic speck in the Atlantic. In three months they had built a runway more than a mile long. Paving this field close to the equator required a mix made of volcanic ash and rock instead of the usual sand and stone. All heavy equipment was worked 22 to 24 hours a day and was serviced during mealtimes. More than 380,000 cu.yd. of rock was removed and more than 250,000 cu.yd. was placed in fill. In excavation work 165,000 cu.yd. of rock was blasted, the engineers using 13,000 blasting caps and 35½ tons of high explosive.

Munda—Navy Seabees found a large pile of expended anti-aircraft shells and welded them into a 2,000-ft. brass drainage system for a 1,500-bed hospital on Munda. The bases of the shell casings were converted by the ingenious Seabees into attractive ash trays for the same hospital.

Salerno—The War Department's Bureau of Public Relations tells how four trucks helped an Army engineer aviation battalion to build three airfields on the beachhead during the invasion of Salerno. The Army equipment got the job done on time, despite a private battle with the Luftwaffe and two hurried evacuations to escape breakthroughs. One airfield was constructed within twelve hours after landing and the other two were completed within seven days.

England—"The vast airfields in England, from which we now pour destruction into Hitler's roofless fortress of Europe, were built largely by American engineer units and almost entirely by American-made heavy equipment," says Maj. Gen. Eugene Reybold, Chief of Engineers, U. S. Army, and he continues:

"What we learned in our civil works program about soil strength and the work capacity of heavy mechanical equipment has contributed to feats of military training which have astonished the world. Heavy earth-moving equipment, designed originally in large measure for flood control projects, is now recognized as combat machinery for its work on airdromes, military roads and other war-essential projects in every theater of operation."

New Guinea—In three months at Saidor the 32d Division of Engineers has established a base 15 miles in circumference. Completed or nearly finished are two 6,000-foot runways with dispersal areas and several revetments for planes, 30 miles of graveled roads, various docks, a pipeline jetty and a PT patrol boat base.

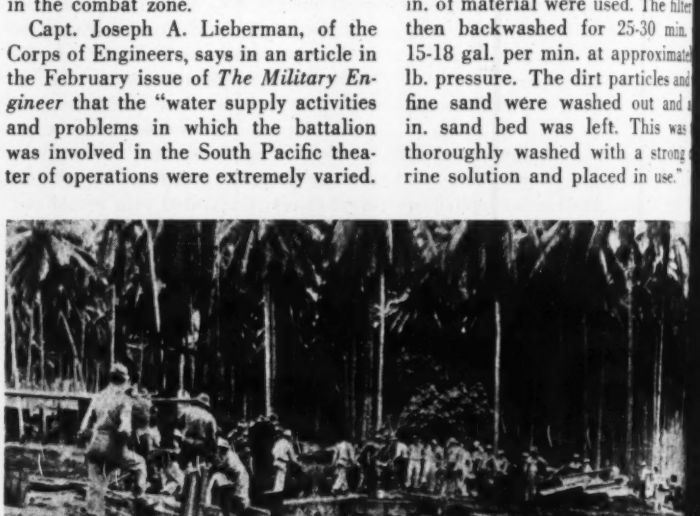
New Caledonia—The 118th Engineer Battalion (C), the engineer component of the 43rd Infantry Division, has been in the South Pacific area for about a year. Three months were spent on the semi-tropical island of New Caledonia in the communications zone, and seven in the combat zone.

Capt. Joseph A. Lieberman, of the Corps of Engineers, says in an article in the February issue of *The Military Engineer* that the "water supply activities and problems in which the battalion was involved in the South Pacific theater of operations were extremely varied. Sources, equipment, treatment, and icing over the period presented different problems.

"In almost every instance there no regular water reconnaissance for location of the source, the transport of the equipment to the site and setting up of the equipment. The procedure was to set up the water to deliver water in the shortest pos time, then to develop it to include quate storage and servicing facil The construction of access roads loops, platforms, towers, and pipe formed a considerable part of the

"When the battalion left the U States for overseas duty it was equi with the normal four standard port water purification units. These consist of a pressure filter pump, rinator and chemical feed tank, ca tanks and necessary suction and charge hose, and spare parts. The tion of the unit under all condi proved that it is an excellent pie equipment.

"Sand replacement for the pre filters was not readily obtainable coral sand was used with much suc Ordinary beach sand was ro screened with the filter screen to re the larger particles and stones, and placed in the filter. Approximate in. of material were used. The filter then backwashed for 25-30 min. 15-18 gal. per min. at approximate lb. pressure. The dirt particles and fine sand were washed out and a in. sand bed was left. This was thoroughly washed with a strong rine solution and placed in use."



U.S.M.C.

Floods give engineers extra work on Guadalcanal

This Lunga River bridge on Guadalcanal was the victim of a flood caused by tropical rains. Marine engineers are pictured starting reconstruction work.

Guadalcanal has two seasons, the rainy (between November and May) and the wet, the rest of the year. There is no dry When the rainy season reached its p cently, American troops were amazed vast quantities of water that poure the clouds. As much as eight inches fell in twenty-four hours.

s Angeles contracts to ish Aliso viaduct

spects that Los Angeles' Aliso St. t (*ENR*, March 4, 1943 vol. p. was destined to become a "white nt" until the post-war period dissipated recently by a coopera- greement entered into by the city er's office and the contracting ngaged to finish the structure.

Jan. 31, 1943, the WPA ceased on the project, leaving the viaduct 87 percent completed. Expendi- to that date totaled $4,231,446. portions of the project were left rious stages of completion. How- most of the materials required to lete the work had been purchased ome equipment was available for Contracting Engineers Co. of Los es was the successful bidder for letion of the project.

npletion of the viaduct, about l, will eliminate a long-existing bottleneck while serving as a rn and important connecting link en the city's heavily populated ide and downtown Los Angeles. or to 1939 the crossing of Los es river at Aliso Street was ef- by a three-span steel truss and bridge, constructed in 1904, over two Pacific Electric Railway were laid in the center of the with single traffic roadways on side of the tracks. Traffic pass- er this old structure was obliged ss steam railway tracks on grade ch end of the bridge.

reinforced concrete structure

new viaduct is a reinforced con- structure throughout, and it s the river with one 222-ft. span, ntly elevated to join the ap- es and provide overhead grade tions at all main railroad tracks along the river banks.

viaduct crosses a principal road- n a three span continuous hollow rder unit and has 19 concrete rame approach spans of 35 to 40 make a total length of main span 8 ft. The bridge has a width of the center 22 ft. accommodating rban railway tracks. "Peeling- d "braided" ramps at grade sep- ns have widths of 24 or 35 ft. gn of the structure and all engi- g services in connection with the t were provided by the regularly yed personnel of the city under irection of City Engineer Lloyd h. The completed cost of the t, including rights of way, dam- engineering, inspection, changes lroad facilities and construction will be about $5,000,000.

Canadian A.W.W.A. men meet at Niagara Falls

The twenty-fourth annual meeting of the Canadian Section of the American Waterworks Association was held in Niagara Falls, Ont., on April 20-22 and attracted the largest attendance yet achieved. Dean S. B. Morris, president of the A.W.W.A. was an honored guest and spoke at the opening luncheon. Professor Alan Coventry spoke on the need for water conservation and Dr. B. H. Mackay of the Geological Survey of Canada spoke on geological aspects of underground water. Technical papers were discussed, and "guided discussions" again proved successful.

A. W. McPhail, superintendent of waterworks for St. Catherines, Ont., was elected president for the coming year, succeeding T. M. S. Kingston, city engineer of Chatham, Ont. The Fuller Memorial Award was presented to William Storrie, consulting engineer of Toronto, for his distinguished services in the waterworks field. Dr. A. E. Berry, director of the sanitary engineering division of the Ontario Department of Public Health, was re-elected secretary-treasurer.

Port Huron, Mich., votes for a filtration plant

Residents of Port Huron, Mich., recently approved construction of a new $730,000 filtration plant in an advisory vote sponsored by the city council. More than 2,800 votes were cast in favor of the proposal and 844 against it, the total exceeding votes cast in the preceding regular municipal election.

• • •

New power line approved for Portland, Ore.

The Portland General Electric Co., has obtained approval of the Portland city commission to construct a 115,000-volt power line across the Willamette River at St. Helens road.

The Bonneville power administration had sought city permission to construct the line, War Production Board sanction awaiting only on authority from the city to undertake the work. The PGE has been granted priorities for completion of the line, which will cost about $250,000 and bring power into the new west side industrial area.

MEN AND JOBS

Col. Fisher S. Blinn of Marion, Ind., who was sent to Alaska in 1940 by the Seattle U. S. Engineer District as a resident engineer on early defense construction, has been awarded the Legion of Merit for outstanding service as resident engineer and commander of engineer troops on Amchitka, reports Lt. Gen. Simon Bolivar Buckner, Jr., Alaskan department commander.

Col. Blinn has served as resident engineer at several important army engineer construction projects in Alaska. A graduate of the U. S. Military Academy, 1924, he received a master of science degree in civil engineering from the University of California in 1928.

Maj. Archer W. Bedell, for the past two years on duty with the Corps of Engineers at the Seattle Port of Embarkation, has returned to civilian life, reverting to inactive army status, in accordance with the U. S. Army policy of relinquishing any specialized personnel for whom assignments commensurate with qualifications, grade and age no longer exist.

Major Bedell's home is in Faribault, Minn., where he was an engineer with the Minnesota State Highway Department. He had been Rice County and Faribault city engineer. He served with the national guard in New Mexico and later as a first lieutenant in the Infantry in the first World War. On May 1, 1942, he became an engineer supply officer at the Columbus, Ohio, general depot and not long thereafter was transferred to Seattle.

Austin B. Smith, chief of the dredging and navigation section of the Mississippi River Commission, Vicksburg, Miss., has been promoted to major, according to Brig. Gen. Max C. Tyler, commission president. Major Smith, formerly assigned to the Vicksburg Engineer District, has been with the Commission since 1935.

(*Continued on page* 128)

JOBS OF THE WEEK

REFUSE INCINERATORS, Honolulu, T. H.

City and County of Honolulu, awarded a contract to MacDonald Construction Co., St. Louis, Mo., for two refuse incinerators to cost $1,060,000. Each includes 3-story, reinforced concrete building on pile foundations, with 1 and 2-story additions, one 50-ft. reinforced concrete chimney, trucking ramp, driveway, two furnaces with auxiliary equipment. Metcalf & Eddy, Boston, Mass., are the engineers.

APARTMENTS, Dallas, Tex.

Parkcrest, Inc., Dallas, will build 10 apartment buildings by force account and sub contracts. The estimated cost is $600,000.

ROADS, Pennsylvania

Pennsylvania Department of Highways, Harrisburg, awarded a contract for improving 5.73 mi. U. S. 22, Lower Paxton and West Hanover Townships, Dauphin Co., to Buffalo Gravel Corp., Camp Hill, Pa., at $717,378; also 5.87 mi. U. S. 22, West Hanover and East Hanover Townships, Dauphin and Lebanon Counties, to Union Building and Construction Corp., Passaic, N. J., at $917,910.

HOUSING, New Orleans, La.

Public Housing Authority, Fort Worth, Tex., received the lowest bids for 150 permanent houses from R. P. Farnsworth & Co., Inc., New Orleans, La., at $914,817. Allison Owen and Goldstein Associates, New Orleans, are the architects.

HOUSES, Seattle, Wash.

Nettleton & Baldwin, Seattle, Wash., will build 240 houses, on Lake Washington for Ridge Homes, Inc., Seattle. The estimated cost is $1,250,000. Stuart & Durham, Seattle, Wash., are the architects.

AVIATION FACILITIES, Seal Beach, Calif.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for aviation facilities at Marine Corps Air Station, to P. J. Walker Co., Los Angeles, at $886,666.

EXPANDING FACILITIES, Coronado, Calif.

I. C. Curry and F. E. Young, San Diego, have been awarded a contract to construct additional facilities at Amphibious Training Base by Bureau of Yards & Docks, Navy Department, Washington, D. C., at $1,934,000.

HOUSING, New Orleans, La.

Franklin Estate Corp., New Orleans, La., has awarded a contract to build housing and facilities to Evans & Inman, New Orleans, at an estimated cost of $1,000,000.

CAFETERIA BUILDING, Renton, Wash.

Goerig, Phelps & Strand, Seattle, Wash., was the lowest bidder for the construction of cafeteria building, equipment building and personnel building, addition for Boeing Aircraft Co., Seattle, at $957,560. Defense Plant Corp. will finance.

EXTENDING RUNWAYS, Grand River, Alta.

Western Construction & Lumber Co., Ltd., Edmonton, Alta, has been awarded a contract by Department Munitions & Supply, Ottawa, Ont., for runways extension and additional work at airport. The estimated cost is $1,000,000.

DWELLINGS, Los Angeles, Calif.

Krandill Mortgage & Investment Co., Los Angeles, Calif., will construct 200 frame and stucco dwellings, at Manhattan Pl. and 94th St., by its own forces. The cost will be about $700,000.

SINGLE FAMILY DWELLINGS, San Pedro, Calif.

Brittian Construction Co., Los Angeles, Calif., will build 280 single-family dwellings for San Pedro Housing Co., at an estimated cost of $1,250,000. James R. Friend, San Pedro, is the architect.

DETENTION UNIT, Shoemaker, Calif.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for the construction of 2,500-man detention unit, receiving barracks, to A. Farnell Blair, San Francisco, at $2,452,445.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 189.

Canadian professionals exempt from labor law

Persons employed in a professional capacity do not come under the provisions of the new Dominion labor code according to a decision of the Canadian Wartime Labor Relations Board announced on April 14. The board held that persons employed in a professional capacity "shall be deemed to be employed in a confidential capacity" and so are excluded from the provisions of the labor code, as are persons who have authority to employ or discharge workers.

When the new federal labor code was under consideration the principal engineering and architectural organizations of Canada urged that professional men be excluded from its collective bargaining provisions (*ENR* June 24, 1943, p. 913), but despite this protest professional men were not specifically excluded from those coming under the provisions of the federal code when it was adopted. The code defined an employee as "a person employed . . . to do skilled and unskilled manual, clerical or technical work", and there were no exceptions.

Consequently, at the first official sitting of the new Wartime Labor Relations Board, L. Austin Wright, secretary of the Engineering Institute of Canada and W. P. Dobson, president of the Dominion Council of Professional Engineers, supported by a delegation from the main engineering and allied societies, appeared before Mr. Justice O'Connor, chairman, to renew their appeal. The engineers stated that they were not opposed to the principle of collective bargaining, but held that professional men should not be compelled to come under an agreement made by a trade union. The board subsequently announced that professional men are to be excluded.

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Mexico water treaty opposed by Nevada

Abandoning its heretofore neutral stand on the pending Mexico water treaty, the state of Nevada on May 2 sided with California in opposing ratification of the pact which would grant 1,500,000 acre-ft. of Colorado River water annually to Mexico (*ENR*, May 2, p. 299).

Opposition to the treaty, which has been submitted by the State Department to the U. S. Senate for formal approval, was expressed by members of Nevada's Colorado River Commission in a communication to members of the state's Congressional delegation.

OBITUARY

...an Blake Gordon, 64, director of ...ary engineering for the District ...olumbia, died at Washington on ...9. Mr. Gordon was born in Wash... and took his civil engineering ...e from Columbia University in ... His service with the district gov...ent began in 1900. From 1905 ...910 he was in private engineering ...tice. He was an officer in the ...neers Corps in the first World ...

...obert C. Whiting, 66, vice presi... in charge of personnel and labor ...ions since 1924 for the George A. ...er Co., New York building con...tors, died in New Rochelle, N. Y., ... 11. Mr. Whiting was graduated ... the Alabama Polytechnic Insti... in 1897. Chairman of the arbi...ion board of the Mason Builders ...ociation for the last six years, he ... a member of the arbitration board ...he Master Carpenters Association, ... a former president of the Building ...des Employers Association of New ...k.

...L. F. Sanborn, chief construction ...ineer for the J. B. Warrack Co. of ...ttle for 17 years, died April 26. He ... graduated from Iowa State College ... civil engineer and served as an ...llery lieutenant in France during ...rld War I. He was at one time presi...t of the Pacific Northwest branch, ...ociated General Contractors of ...erica, and also of the Seattle branch.

...William J. Sadler, city engineer and ...er superintendent at Port Townsend, ...sh., for 20 years, died recently in ...kane. He held his Port Townsend ...itions from 1910 to 1920 and from ...7 to 1937.

...Charles Hendry, 49, of Hillside, N. ... general engineer for the Crucible ...el Co. at Harrison, N. J., died May 3. ... was graduated from Union College, ...ved in the Navy in the First World ...r. He had served on the New Jersey ...e Board of Professional Engineers.

...Henry E. Swelgard, 70, a retired ...lding contractor for 55 years at ...aha, Neb., died April 30.

...Georges Joseph Desbarats, 83, first ...uty Minister of National Defense ... Canada, following the amalgama... of army, naval and air forces in ...2, died in Ottawa on April 28. Mr. ...barats was an engineer, and a past president of the Engineering Institute of Canada.

Adolf F. Wagner, 85, founder and president of the A. F. Wagner Iron Works of Milwaukee since 1890, died April 24.

Walter Henry Joyce, 63, contractor of Regina, Sask., since 1906, died April 17.

Clarence J. Rommel, 51, vice-president of the George H. Rommel Construction Co., Louisville, Ky., a member of the firm for 25 years, died April 19.

Palmer W. Blanchard, 51, president of Blanchard Brothers Construction Co., died April 28 at Denver, Colo. Born in Creston, Ia., he went to Denver as a youth, and joined with his brothers in the construction firm bearing his name. Many of the highways of Colorado and Wyoming were built by them.

George S. Beckwith, 70, who first conceived the idea of a bridge across San usky Bay, died at Cleveland, Ohio, recently. The bridge, which cost nearly $2,000,000, was opened in 1929.

Paul Ogilvie, 66, civil and highway engineer and a life-long resident of Ottawa, Ont., died there May 4. Mr. Ogilvie was at one time in charge of construction work on the Rideau canal while employed as a city engineer. He was also a civil engineer with the Canadian Pacific Railway for a number of years as well as highway engineer with the Ontario Department of Highways.

CONTRACTS AND CAPITAL

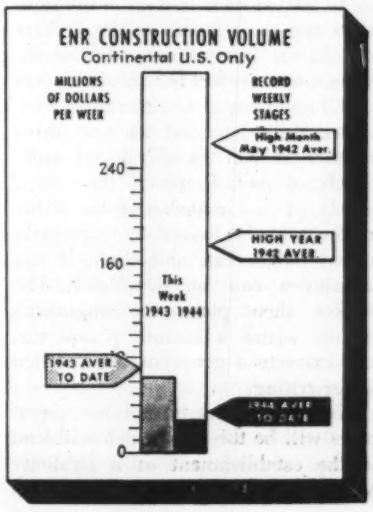
CIVIL ENGINEERING construction volume in continental U. S. totals $26,907,000 for the week. This volume, not including the construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 36 percent lower than a week ago, 58 percent under the total for the 1943 week, and 3 percent below the previous four-week moving average.

Private work is 30 percent lower than last week, and down 5 percent compared with the week last year. Public construction is 39 and 68 percent lower, respectively, than a week ago and a year ago.

The current week's construction brings 1944 volume to $706,134,000 for the 20-week period, a decrease of 51 percent from the $1,445,294,000 reported in 1943. Private construction, $163,047,000, is 12 percent above the 1943 period, but public construction, $543,087,000, is 58 percent lower as a result of the 62 percent decline in federal. State and municipal is 1 percent under a year ago.

In the classified construction groups, gains over last week are in bridges, commercial buildings, and streets and roads. Gains over the 1943 week are in bridges, commercial buildings, earthwork and drainage, and highways.

New capital for construction purposes for the week totals $3,755,000. It is made up of $1,175,000 in state and municipal bond sales, and $2,580,000 in corporate security issues. New construction financing for the year to date, $415,907,000, is 15 percent lower than the $489,749,000 reported for the 20-week period in 1943.



CONTRACTS

Continental U. S. Only (Thousands of Dollars)

	Week Ending May 20 1943	May 11 1944	May 18 1944
Federal	$49,558	$21,580	$10,467
State & Municipal	4,162	6,807	6,716
Total public	$53,720	$28,387	$17,183
Total private	10,209	13,822	9,724
TOTAL	$63,929	$42,209	$26,907
Cumulative 1944 (20 weeks)			$706,134
1943 (20 weeks)			$1,445,294

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	1943 20 Weeks	Cumulative 1944 20 Weeks
NON-FEDERAL	$89,399	$170,641
Corp. Securities	2,821	72,499
State & Mun.	74,945	44,362
RFC Loans	8,500	53,780
FPHA Loans	3,133	
FEDERAL	$400,350	$245,266
TOTAL CAPITAL	$489,749	$415,907

ENR INDEX NUMBERS

Index base=100		1913	1926
Construction Cost	May '44	298.00	143.25
Building Cost	May '44	234.80	126.93
Volume	Apr. '44	106.	46.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Faith of the Engineer

Sir: Your editorial (*ENR*, April 6, 1944, vol. p. 462) and your publication of that inspirational statement "Faith of the Engineer," prepared by the Engineers Council for Professional Development, has given many, including myself, a great sense of uplift.

As a reader for about forty years, of *Engineering News-Record*, it is with a keen sense of gratitude that I would like to testify to the high moral policy which has always dictated its publication of valuable technical data with consideration given to social and economic implications.

MAURICE DEUTSCH,
Consulting Engineer,
New York, N. Y.

Editor's Note—Over 600 requests have been filled for copies of the statement, "Faith of the Engineer." Suitable for framing, they are still available at no charge from the Editorial Department, *Engineering News-Record*, 330 W. 42d St., New York City.

Photo-Biographies for Schools

Sir: On May 6, two Lehigh University alumni, Arthur T. Ward, Class of 1913, and myself, Class of 1893, presented to Lafayette College through C. C. Williams, president of Lehigh, a photo-biography of John Markle, a famous mining engineer who graduated from Lafayette in 1880. Last October we presented a similar photo-biography to Lehigh covering the life of James B. Eads; mounted in a frame, it contains an original letter from Mr. Eads to General Beauregard, a picture of the Eads Bridge at St. Louis, a biography of Eads and an etching of him. This photo-biography now hangs in the corridor of Packer Hall at Lehigh.

Mr. Ward and myself believe that the education of engineers is deficient in two qualities, the first being a thorough knowledge of the history of engineering and of engineers. Dr. Ruth Watson, in an address before the Brooklyn Engineers Society, said that architects have a high respect for their profession, because they were steeped in the history of architecture. The second deficiency is that engineers, themselves, through training or modesty are inclined to belittle their own work. The American Society of Civil Engineers has tried to raise the standards of the profession by issuing a code of ethics and have revised this several times to suit new conditions. Codes of ethics, however, are negative in their appeal and they do not attract the general public.

Mr. Ward and myself believe that the Ten Commandments and the Golden Rule constitute the best codes of ethics for engineers or any other business. We have attempted to remedy the engineers' complex through "photo-biographies," thereby painlessly imparting what President C. C. Williams calls "emotional inspiration through hero worship." We further believe that the photo-biographies will develop increased respect for our profession and thereby raise the ethical tone of engineering.

Today it has become popular for the custodians of public funds, who call themselves bankers, to depreciate engineers as spenders, to be discharged as soon as possible.

The general public seems to be willing to intrust their morals to the ministers and their health to the doctors without the intervention of bankers. When a new project is born, engineers must be employed to determine first, its feasability, second its cost, third whether it can be developed sufficiently ot pay, fourth if there is a supply of raw material, fifth, if the product can be moved to markets at a reasonable cost, and sixth, if any substitutes can be developed. The banker then picks the engineer's brains, writes a smooth prospectus, and extracts a generous slice, called underwriting.

We believe that our photo-biographies will be the seed which will lead to the establishment of a publicity bureau, through some such medium as Engineering Foundation, which will exalt the engineering profession in a dignified manner. Then the engineer will step into his rightful place in the minds of the public, and the enterprizers can underwrite these projects backed by the sagacity of the reports of established engineers.

LEWIS D. RIGHT
Consulting Engineer
Roselle, N. J.

Moisture Content in Sand

SIR: Attention should be called to the fact that the percentages of moisture given in C. R. Waters article in *ENR* March 9, 1944, p. 341, are based on the weight of moist sand involved. There are some engineers who base their percentages of moisture on the dry weight and there is some difference in the percentage values, the greater differences occurring at the higher percentages. In the range found in concrete sands there is not much difference between values based on the wet weight and the dry weight.

For the benefit of those who might like to make use of this technique of moisture determination and who do not find it convenient to use the quantities mentioned in the article, it might be well to publish a basic formula for percentage of moisture which can be used under varied circumstances. One for each basis is given below. The writer finds it more convenient to use percentages based on dry weights. Let

w = percentage of moisture.
W = weight of moist sample in grams.
W_a = weight in grams of pycnometer full of water.
W_b = weight of pycnometer, material and water.
G = specific gravity of material.

$$w = \frac{W - \frac{W}{G} - (W_b - W_a)}{W_b - W_a} 100 \text{ dry basis}$$

$$w = \frac{W - \frac{W}{G} - (W_b - W_a)}{W - \frac{W}{G}} 110 \text{ wet basis}$$

In Mr. Waters method the weight W is always 1,000 times the specific gravity of the sand. The writer prefers to use a constant weight of moist sand rather than a variable one, believing there is less chance for making mistakes. Tables and diagrams can be prepared just as easily for one as the other. The item $(W_b - W_a)$

above formulas is equal to the ues in Mr. Waters table headed ombined Weight in Grams of Sand d Water" minus 2,000 g.

When many of these tests are made th the same pycnometer, the sub- ction of W_s from W_b can be elim- ted by the use of a counterbalance ight equal to W_s when the weight is secured. This eliminates the ssibility of making a mistake in thmetic in securing the difference.

Determination of moisture contents concrete aggregates, soil, and soil- ment mixtures without taking the e to dry out a sample is increasing. e of the first methods used was to igh the moist sample in air and en suspended in water. For this rpose the late Professor Dunagan Iowa State College developed a ecial balance which is built for use the field. When the pycnometer is ed, the difference between weights, and W_b, is the same as the weight spended. The use of the pycnometer much more convenient because it es not require unusual equipment.

Any kind of a container may be ed as a pycnometer so long as it n be filled with the same amount water repeatedly. Messrs. Catton d Felt at the meeting of the High- ay Research Board in Chicago, in ovember 1943, told of the use of a qt. glass fruit jar, in a paper en- led "Weight-in-Water Methods of etermining Moisture Contents of oil-Cement Mixtures." A siphoning evice is used to fill the jar to the me level each time. The writer is nding a 500-ml. or a 1,000-ml. flask conventient container to use in the boratory.

EDWARD E. BAUER,
Assistant Professor of Civil Engineering, University of Illinois.

pecification Principles

Sir: Since Mr. Porter quotes some hrases from my article on specifica- ons in his "A 7-Point Plan to hieve More Satisfactory Specifica- ons" (*ENR*, March 23, 1944, p. 30), I feel that there should be some buttal. I concur in his estimate of a ecification writer and in his pro- sal for finished structure specifica- ons. It is a splendid idea, if the field gineers will recognize the impor- nce of these final specifications and eir employers will allow them the time necessary, after the final estimates are completed, to prepare such specifications. Generally, there is another job waiting, and such things as final plans and specifications and job reports recommending changes in design are accessories to the completed project, which may or may not be conscientiously completed.

As to leaving the tolerances to the field engineers, this would be a happy solution, if all field engineers and inspectors were fully qualified as designers before they went to the field. but, unfortunately, the industry is filled with many men who have no formal engineering education and whose qualifications as inspectors are based on field experience alone, or, in the case of some local government projects, on their political aptitude.

I agree that the field engineers have a right to complain about the restrictions emanating from the main office. and feel that these restrictions should be lifted as far as possible, particularly where they apply to methods of construction, but tolerances are vitally necessary if the structure is to conform to the designer's original ideas. Both engineers and contractors would be subject to considerable criticism if one field engineer allowed a variation of $\frac{1}{16}$ in. per ft. in a finished floor and another in an adjacent structure allowed $\frac{1}{4}$ in. per ft. in the same type of construction. Our finished products would present most peculiar appearances, if one inspector allowed a sag of 1/180 of the span in a ceiling and another allowed 1/480. And where would the steel manufacturers and constructors be if there were no specified tolerances for rolling steel shapes? This could go on and on.

Mr. Porter defends the phrase "as directed by the engineer" and I agree that there are occasions where such a phrase is necessary, but when he suggests that the color of a given paint may be as directed by the engineer that is an admission of inadequate design, for the colors in a completed design should be selected before the contract is awarded. Some color pigments are considerably more expensive than others and in such cases the contractor is at the mercy of the engineer.

There must be some latitude in the design of concrete mixes, but in general, the latitude in most concrete specifications has been all on the engineer's side. The engineer specifies the strength, the mix, the water, the cement, practically everything but the intelligence quotient of the mixer operator, and then adds that concrete shall be mixed as directed by the engineer. There are many contractors who can testify that the engineer's idea of the water in the mix has cost them plenty of money.

In his reference to the placing of additional fill after settlement, Mr. Porter has provided the necessary safeguard which should accompany the use of the phrase "as directed by the engineer." In this case, a method of additional payment is provided to cover the contractor's additional expense, if the directions of the engineer entail additional work beyond the limits of his contract; and at the same time the engineer is placed on notice that his directions may cause an increase in the contract price.

Here's to the day when the "red tape" and "verbosity" are not required to make specifications adequate for their needs.

D. V. PURINGTON.
Civil Engineer, Ft. Stockton, Tex.

Lining Improves Appearance

Sir: This office has received a letter from the United States Rubber Co., Passaic, N. J., manufacturer of the absorptive paper used at Norfork Dam, questioning the statement made in the letter "Concrete at Norfork Dam" on p. 537 of the April 20, 1944, issue of *Engineering News-Record*. The letter should have stated "It is true that the absorptive paper does create a surface pleasing in appearance" instead of "It is true that the absorptive paper does not create a surface pleasing in appearance."

MAJ. H. E. MURRAY, ASSISTANT
Corps of Engineers, Little Rock, Ark.

Concrete Design Charts

Sir: Thank you for transmitting to me the requests for larger size copies of the charts in the article, "Rapid and Simple Concrete Proportioning," appearing in *ENR*, March 23, 1944, vol. p. 426. I will be glad to supply single sets of these charts, at no charge, to interested persons.

L. D. LONG,
Newark Testing Laboratories, 80 Lafayette St., Newark 5, N. J.

EDITORIALS

VOLUME 132 NUMBER 20

May 18, 1944

History Holds the Verdict

CANOL, the War Department's oil well, pipe line and refinery project in Northwest Canada and Alaska, went into operation early this month. And although this ends the argument over whether it should be completed or abandoned, enough disagreements over fact still remain to assure Canol a place as one of the war's most controversial construction jobs. Yet why it should have generated so much heat is rather puzzling. There are those who claim it should never have been started, but they would seem to have a short memory, forgetting the precarious position of our sea lanes to Alaska in the Spring of 1942. There are others who oppose it because the Army and not some other governmental agency was in charge, but such arguments are rather pointless in wartime. Likewise the charges of waste and excessive cost make little sense; one might as well say that the millions spent in Eritrea or the Caribbean islands for bases that were never used were wasted, instead of recognizing that they actually represented insurance premiums. All in all, the only "open" argument is whether we would have been better off to have abandoned the job when its strategic importance declined, rather than to finish it. Since we did finish it, history will have to supply the verdict. In the meantime, the building of the Canol pipe line, as described in this issue, can be studied with profit and regarded with pride. Like the Alaska Highway, it is a monument to the men and machines of the American construction industry.

International Engineering

LOOKING TOWARD WIDER HORIZONS in the postwar period, many engineers and construction companies entertain the hope of participating in Latin American developments. As a general rule, collaboration of this kind in the past has been fraught with difficulties and uncertainties that have tended to discourage rather than promote effective cooperation. Recognizing these many obstacles and desiring to remove them, delegates from the 21 American republics are meeting this week and next in New York City under the sponsorship of the Inter-American Development Commission. This organization, established in 1940, is composed of citizens prominent in private financial, industrial and engineering circles and government representatives from the 21 countries. In no sense a financing agency, the functions of the commission include the making of technical studies, compiling basic information relating to the economies of the Latin American nations and the establishment of contacts between individuals and groups interested in developmental activities. In the latter respect, the Inter-American Development Commission is ideally organized to be of special service to engineering and construction firms, and from its permanent headquarters in the Commerce Department Building, Washington, can act as a clearing-house on questions relating to international engineering matters south of the border.

All in One Basket

IT REQUIRES INTESTINAL FORTITUDE as well as confidence born of careful study for a contractor to invest a substantial proportion of the total construction cost of a job in an untried scheme of construction long before any income from it can be realized. Top example of the successful application of such procedure is perhaps the huge cableway set-up at Shasta Dam yet fully as large a proportionate risk was taken on construction of a trestle over a swampy floodway, described in this issue. In the latter case, the innovation consisted in doing all the work from gantry rigs spanning the trestle, and all the equipment and the forms for 3½ miles of bridge, costing nearly 20 percent of the contract price, had to be built before any part of the plant could be tested. It worked efficiently and economically, probably because advance planning included careful investigation of all possibilities. For example, actual manpower requirements for every operation were estimated and found to be cheaper than for any other scheme investigated. Putting all the eggs in one basket requires planned packaging for the eggs and adequate means for moving them—but frequently it speeds up the work and promotes greater efficiency, as it did on this project.

Electric Motor Maintenance

KEEPING CONSTRUCTION MACHINES in efficient operating condition, always an important consideration, has become the prime necessity during the war period when replacements are difficult to obtain. Since new electric motors are particularly

arce, maintenance of those in service becomes usually important. Partly for this reason and o because the electric motor is one of the least derstood of construction machines, the article this issue giving practical, down-to-earth suggesns for a periodic inspection and maintenance hedule on motors is of more than ordinary sigficance. Knowing that some poor operation will cur despite good maintenance practice, the thors have also included trouble-shooting check ts for motors operating improperly. Although ese charts contain some suggestions that might ppear obvious, they were planned to provide a pid check of all the causes of poor motor perrmance, plus instruction as to the remedy. They e vital now and useful always, especially if put in e hands of the electricians who do the maintenace work.

Controlling Floods

TWO FLOODS IN SUCCEEDING YEARS that rose to ecords not attained in the middle valley of the ississippi River in 100 years have served to vive interest in flood control in that great river d its major tributaries. Public opinion divides nerally into two schools of thought, those who ink that expenditure of vast sums required to ntrol floods along the Mississippi is a waste of deral money and those who consider those penditures as justified as a means for eliminatg or at least minimizing recurring loss of propty and human suffering that is so widespread as be of national concern. The latter view was cepted by Congress in 1936, when it passed the rst flood-control act. Prior to that time, federal od-control work on the Mississippi had been rried forward only as an adjunct to the improvent of the river for navigation.

What the opponents of further flood-control work ppear to overlook is the fact that this is not entirely question of adopting a new policy. In large easure it is a question of how much we are justid in spending in continuation of a policy which s already committed the nation to a very large vestment.

Take as an example the St. Louis District of the pper Mississippi Valley Division, where the fight s year saved 300,000 acres of rich bottom land, ousands of homes and many miles of road and ilroad from inundation. There, the battle, begun years ago by the local landowner and now shared by the states and federal government, is nearly won. The leveed land already is protected against all but a major flood. Consequently, expenditures made to complete the levee system and strengthen the weak points revealed by the 1943 and 1944 floods will not only reduce future possible damage but will insure a return on past investments.

Below Cairo, on the other hand, where the topography changes and the river flows out over the aluvial plain built up in prehistoric times, it can be said with reasonable assurance that the fight has been won. The river must still be watched when in flood, banks must still be protected, and occasionally the floodways will have to be put into service, but there is now little reason to fear that the river will go over its banks and start cutting a new channel as it did periodically for untold centuries.

Not to be overlooked in planning future work is the fact that there may be greater floods in the several parts of the upper Mississippi basin in future years, also that reducing the crest of such floods the two or three feet that mark the difference between protection and inundation will be a costly operation. This means than in future planning there must be, first, a realistic and hard-boiled attitude toward existing or proposed encroachments on the flood channel that unduly restrict the flood flows; and second, that flood control be so integrated with future plans for developing the river system for navigation, power and irrigation as to insure the maximum amount of flood protection without needless sacrifice of storage that might be used for other purposes. As the needs of flood control are largely in conflict with the other three, and as power and navigation needs in turn conflict with those of irrigation, the solution of this problem will not be easy.

Floods like the one that recently brought damage or the threat of damage to thousands of people in Kansas, Missouri and Illinois serve to emphasize how far we have yet to go in controlling those floods and in putting the flood waters to useful purposes. For engineers these floods rise as a challenge to their skill in designing works to convert destructive forces to useful work; but if that design skill is not accompanied by a realistic approach to the economic factors that are involved the engineers will not have fulfilled their responsibility to the nation.

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Controversial Canol

Tractor crane walks a section of the pipeline into Yukon's Teslin River.

Harold W. Richardson
Western Editor, Engineering News-Record

***Contents in Brief**—The Canol oil supply project in Alaska-Canada has now been completed despite storms of protest and criticism directed against the Army for undertaking this large war job. It included developing an oil field at Norman Wells in the wilderness of Northwest Territory, building a refinery transplanted from Texas at Whitehorse, Yukon, installing pumping stations and laying some 1,600 miles of steel pipe. All pipe and supplies for the Norman Wells end of the project had to be transported by barge over 1,200 miles of rivers and lakes, involving a 16-mile portage. The 600-mile oil line from wells to refinery crosses the unexplored Mackenzie Mountains, requiring a pioneer access road most of the way. Pipelines are laid on the surface with all-welded joints.*

CANOL IS NOW COMPLETE. No war project has received so much criticism as has this oil development in northwest Canada, and yet few projects were as strategically important at the time of their inception. When General Marshall and General Somervell and other high-ranking army officers decided to go ahead with the Canol project in April, 1942, the situation in Alaska looked black. The Japs were threatening control of the North Pacific, threatening to invade the Aleutians and the Alaska coast, they and the Germans were sinking our precious tankers all over the world when we were getting into full swing in a global war that required oil, oil and more oil. The Canol project was designed to supply gas and oil to the interior of Alaska and to the airports on our main interior air routes to Alaska. The ultimate change in the tactical situation in the North Pacific lessened the immediate military need for the project, but although the danger of invasion of Alaska ceased to be critical, army officials felt the Canol project still necessary to the war effort, and went ahead with its completion.

Canol heads up in an oil field a Norman Wells on the Mackenzi River, 350 miles from the mouth the river in the shadow of the Arct Circle in Northwest Territory, whic lies east of the Yukon. Alexande Mackenzie, in exploring the river va ley, in 1789, which now bears hi name, discovered oil seeping out the river bank at this very point. I 1920 and 1921 a syndicate of Calgar oil and business men put down th first wells, and the first well wa brought into production in Augus 1920. Shortly afterward the Imperi Oil Co., a subsidiary of the Standar Oil Co. of New Jersey, bought th wells and further developed the fiel

Oil field at Norman Wells expande

The Imperial Oil Co. was given contract by the army to expand th field at Norman Wells. At the start the expansion operations three we were already in production, othe were tapped as they were drilled an brought into production. The wel are shallow, from 1,200 to 1,400 f deep, known as "post holes" in

parlance. They are all pressure so that no pumping equipment quired.

e crude is extremely high grade a paraffin base, but containing little paraffin wax. It flows at 70 below zero, according to reports sts, which answers one of the chief cisms against the project that the annot be pumped at low Arctic peratures during the winter. In the crude is so high grade that a slight adjustment in fuel pumps n be used as diesel fuel without her refining. Imperial in 1939 ted a small refinery at Norman ls; diesel fuel and gasoline from installation supplied the con- ction operations at that end of project.

1,600 miles of pipeline

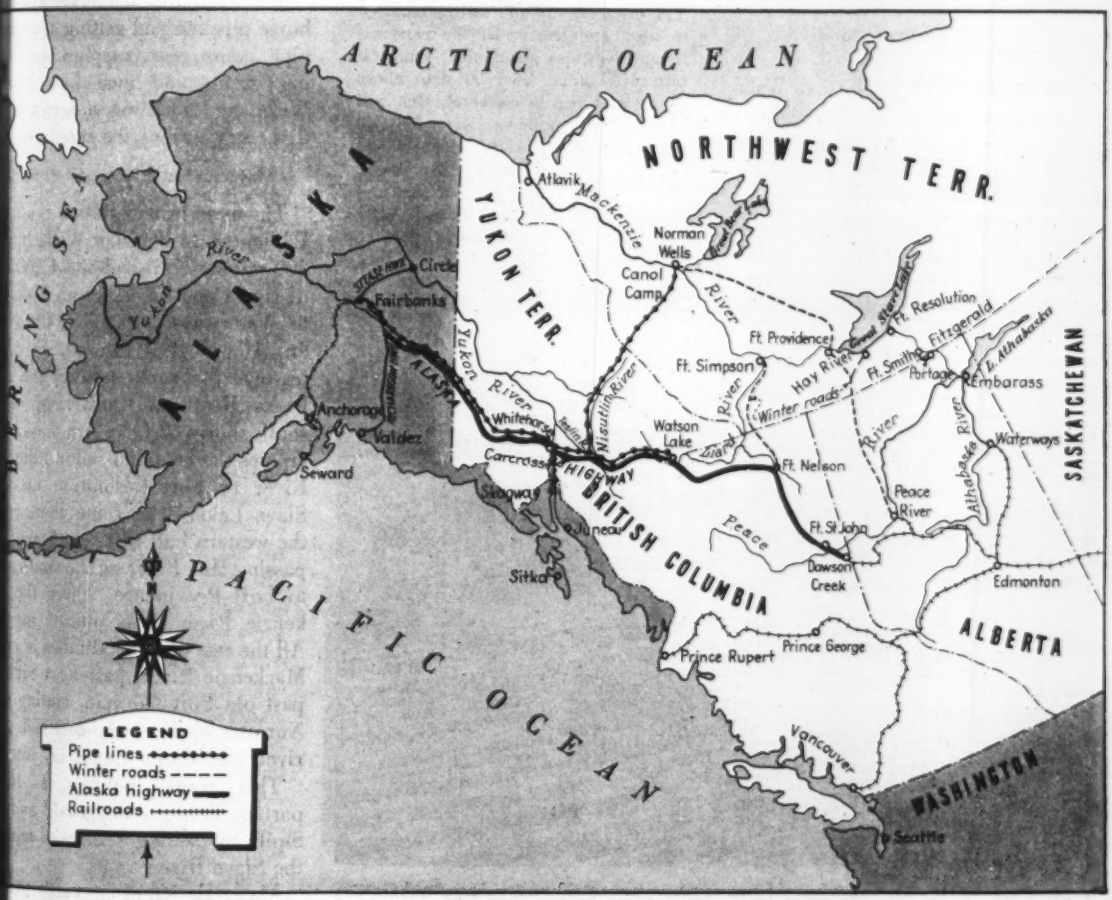
anol is largely a pipeline job— e 1,600 miles of it—and one of most difficult of its kind ever t. From the oil field at Norman ls a pipeline to carry crude oil has been laid southwestward over the wild Mackenzie Mountain range 600 miles to Whitehorse, Yukon Terr. This line strikes the Alaska Highway at Johnson's Crossing of the Teslin River and follows the highway the last 80 miles to Whitehorse.

From Whitehorse a gasoline pipeline has been built along the highway all the way to Fairbanks, another 600 miles, and south along the road to Watson Lake, 300 miles. Another section of pipeline runs from Skagway, at the head of the Inside Passage, to Whitehorse, 110 miles. A cutoff from this line takes off at Carcross to connect with the Whitehorse-Watson Lake gasoline line.

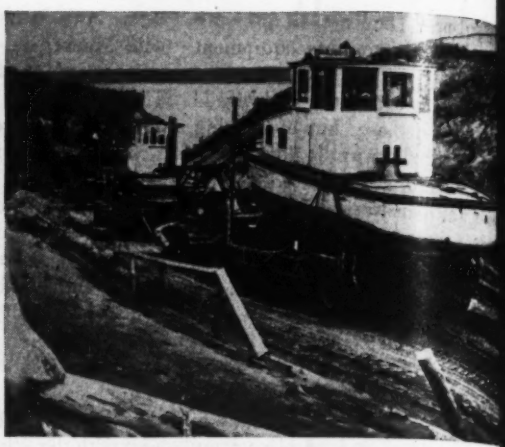
At Whitehorse a refinery has been built to refine the Norman Wells crude. This unit, with a present capacity of 3,000 barrels or better per day, was transplanted from Texas. The scheme of operations is to pump the crude oil from the wells to Whitehorse, to refine it there into high-test gas and pump the gas to various airfields along the main air route to Alaska and to Fairbanks for further distribution. The Skagway-Whitehorse stub line was completed a year ago and has been in use ever since. For a year now gasoline has been pumped from tankers to Whitehorse and distributed up and down the highway to airports by tank truck. As soon as the Whitehorse-Watson Lake gasoline line was completed in 1943 gasoline was pumped directly from Skagway to Watson Lake. The gasoline distribution lines permit flexible operations: Gas can be pumped from Skagway to Whitehorse, Watson Lake or Fairbanks, or can be pumped from the refinery at Whitehorse to tankers at Skagway for distribution elsewhere.

Pumping stations every 50 miles

Pumping stations have been built along the entire network of pipelines, spaced about 50 miles apart, though the exact distance between stations depends upon the topography of the country. Then, of course, tank farms



...ol's 1,600 miles of pipeline sprawl over a vast area of North Country wilderness. The supply line to the Norman Wells ... of the project followed the old water route for 1,200 miles north from the village of Waterways.



A 16-mile portage around the Slave River rapids between Fitzgerald and Ft. Smith was the bottleneck of the w supply route. Tractors hauled barges and tow boats on low-bed trailers over road rebuilt by army engineers. All p equipment, camp gear and other supplies had to be hauled overland at this point.

have been built at Norman Wells and Whitehorse for storing crude oil, at Skagway, Whitehorse and Fairbanks and at the principal airports for storing gasoline. Operation of the refinery and the distribution of gasoline will be under the direction of the British-American Oil Co., which is a subsidiary of the Standard Oil Co. of California.

For 500 miles out of Norman Wells the crude oil line is 4 in., then it changes to 6 in. for the last 100 miles because this size worked out best for hydraulic properties and economical spacing of the pumping stations. Indications of the ruggedness of the job is a sign painted on the bulletin board at the contractor's employment headquarters at Edmonton at the start of work. This sign reads as follows:

THIS IS NO PICNIC

Working and living conditions on this job are as difficult as those encountered on any construction job ever done in the United States or foreign territory. Men hired for this job will be required to work and live under the most extreme conditions imaginable. Temperature will range from 90 deg. above zero, to 70 deg. below zero. Men will have to fight swamps, rivers, ice and cold. Mosquitoes, flies and gnats will not only be annoying but will cause bodily harm. If you are not prepared to work under these and similar condition DO NOT APPLY.—Bechtel-Price-Callahan.

While this warning did not exaggerate conditions to be encounte they were no worse than those fo in building the Alaska Highway the Alaskan and Canadian airp

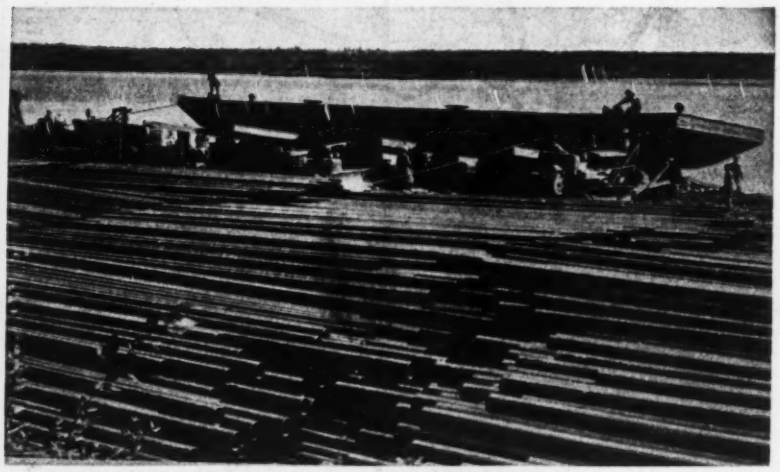
Getting off to a late start in 1 the contractor concentrated on two sections of the project that season—building the Skagway-Wh horse pipeline and getting equipm pipe, camp gear, supplies, well-d ing outfits and men into Norm Wells, and building a series of flight strips along the supply route

Interior supply route difficult

The main transportation route f Edmonton to Norman Wells incl 300 miles of railroad and 1,200 m of rivers and lakes. From Edmon to Waterways, 300 miles, the No ern Alberta R. R. is used. From W terways the route follows the A baska River to Embarrass, on south shores of Lake Athabaska. t crosses the lake and follows the S River to Fort Resolution on G Slave Lake. The route then cro the western half of Great Slave L passing Hay River on the south sh to Fort Providence, where the M kenzie River flows out of the l All the rest of the 500 miles is via Mackenzie River, past Fort Simp past old Fort Norman, ending u Norman Wells on the east side o river and Camp Canol on the w

This route includes a 16-m portage between Fitzgerald and F Smith by-passing a series of rapi the Slave River.

Materials handling yards were e tablished at Edmonton, Waterw Embarrass, Fitzgerald and Fort S



A big barge slides into the river at Ft. Smith after an overland trek across the portage. Pipe, such as that in the foreground, made up the bulk of the freight handled over the long water route to Norman Wells.

esolution, Fort Providence, Wells and Camp Canol. The Bay Company operates a t and barge line on the Great Lake-Mackenzie River run, s utilized, but the army had additional barges and tow this part of the route as well rom Waterways to Fort Res- To equip this water route the pped in prefabricated wooden sections and small tug boats Waterways, where they were d. Then at Fitzgerald, be- of the overland portage, all equipment for the lower sec- he route had to be loaded onto uty trailers and dragged over age by tractors and again put water at Fort Smith. Origin- portage consisted only of a d but the army rebuilt it into lass highway that would stand r the heavy loads.

work was carried on by con- forces and several Engineer ents, including some colored many of them from the deep ho did a commendable job in r north country winter.

n barges supplemented the d 100, 200 and 300-ton barges Waterway-Fort Resolution Of course, every bit of freight e unloaded at Fitzgerald and overland to Fort Smith, and aded on small barges for the Fort Resolution.

ns added to the difficulties

Slave Lake covers an area of sq. miles, and is the fifth larg- e in North America, exceeded Lake Superior, Michigan, On- nd Great Bear, the latter in n Canada. It is subject to storms, therefore all freight e transferred at Fort Resolu- the larger barges operated by dson's Bay Company for the er of the trip. Even with this on there were considerable f equipment and supplies when es were caught in an unus- vere storm. Hay River was ncipally as a port of refuge. ht handled during the first the summer of 1942, consisted of construction equipment— trucks, shovels and scrapers ipe. About 9,000 tons of pipe pped out of Edmonton, but by the water route was closed by ather little of the pipe had

Pioneer roads had to be built ahead of pipelaying on the Norman Wells-Whitehorse section of the pipeline by bulldozer (top) or by shovel and truck (center) to stand up under heavy loads of pipe (bottom).

reached the final destination, most of it being scattered along the various ports enroute.

But not until the second season, the summer of 1943, did the water transportation system really get into full swing. By then the various tugs and barge units were strung out in proper proportion on either side of the portage for more efficient operation. The Hudson's Bay Co. stern-wheeler *Distributor*, assigned to Canol freight, could handle 1,300 tons on barges each trip. This is a wood-burning steamer, and frequent stops must be made to take on fuel.

As fast as equipment could be sent in to the various sites that first summer, ten flight strips were built along the water route. Long runways were graded and surfaced with gravel in an average of three weeks each. Once the air route was complete it was used principally the first year for flying in men, emergency rations, small tools and supplies. This was important, for otherwise it took from three to four weeks to transport men by rail and boat from Edmonton to Norman Wells when the weather was good, longer when storms interfered with the crossing of Great Slave Lake. One large gang was held up for twelve days at Hay River riding out a storm.

Winter trail roads had to be built

To aid in the delivery of material and supplies all the way to Norman Wells that first summer, the army in the winter of 1942-43 built two winter trail roads into the project. One of these started at Peace River, at the end of a branch line of the Northern Alberta Railroad on Peace River, northwest of Edmonton and ran straight north to Fort Providence, with a spur to Hay River and Fort Smith. From Fort Providence the road ran down the east side of the Mackenzie Valley to Norman Wells. The other winter road started at Nelson on the Alaska Highway, following the Fort Nelson and Liard Rivers to Fort Simpson. Both of these routes were nothing more than winter trails, consisting mainly of cleared stretches over frozen ground, passable only when the ground was frozen solid. All the rivers were crossed on the ice. The roads were used principally to transport heavy construction equipment into the project to have it ready for the opening of the 1943 season. Some camp supplies were also hauled over the road. Of course the roads went out with the thaws, about the same time that navigation opened on the water route.

Roadbuilding preceded pipelaying

Except for the Skagway-Whitehorse link, pipelaying did not really get under way until the 1943 season. The big job in pipelaying was the 600-mile stretch between Norman Wells and Whitehorse because of the difficulty of access to this part of the work. The pipe could not be laid until the road was cut through over which the pipe and pumping station equipment and construction camp supplies could be transported. This particular stretch was worked from both ends, the pipe from Teslin River crossing on the Alaska Highway and from Norman Wells. The army started operations in the early spring of 1943 by distributing one of the engineer regiments from the highway at several points between the Teslin and the summit of the Mackenzie Mountains, up the Hyland, Rutlin and Ross River valleys. The equipment was split up into four parts, one group starting at the Teslin and working northeast, the other three going over frozen ground with road-building equipment to three interior locations. Of course the spring breakup isolated these units, but they were able to work both ways from their winter camps and finally by building a pioneer road similar to that in the first stages of the Alaska Highway construction connected up the various sections.

Pipelaying was the biggest job in the whole project. Some pipe was laid along the roadside (top) and some was laid on right-of-way cleared for the pipeline (bottom). Tractor cranes were indispensable in pipelaying operations. The road at the top is typical of Mackenzie Valley pioneer road construction, where the side ditches are carried down to permanent frost and spoil from the ditches is thrown up in the center, over piles of brush, as a base for the fill.

...p in welding up the pipeline is to make the tack welds inside an open clamp holding two lengths together (left) ... last operation is to carefully peen the completed welded joint with a hammer (right) to relieve the stresses.

...e the engineer troops had ...ut late in August. The con... built the Whitehorse-Teslin ...of the crude oil line in June, ...d then started along the army ... road from the Teslin River ... toward the mountains. Mean... ...e contractor also started road ...tion from the Canol Camp ...ross the river from Norman ...oward the mountain pass on ... For the first 50 miles out of ...anol the pipeline route trav... ...e swampy Mackenzie River ...Here the contractors built a ...e of North Country road— ...p all the brush and trees cut ... right-of-way in the center of ..., then cut big side ditches on ...ide, 3 ft. or so deep down to ...ently frozen ground, throwing ...l over the trees in the center ... a foundation for the road fill. ...aterial was then hauled in for ...ing the grade.

...rude oil pipeline crosses the ...ie Mountains through a pass ...5,000-ft. elevation. This range ...er been explored, much less ..., so the route was tentatively ...by aerial reconnaissance, sup... ...ed by forays on foot. But the ...ation was made by the road... ... crews, who worked their way ... the canyons, sometimes back... ...nd trying another gulch when ...g got too tough. When the ...adbuilders pulled out of the ...d of the line, the contractors ...er, improving the army trail ...o one suitable to handle the ... trucks and trailers. However, ...ng was started at both ends ...he road was punched through.

Heavy cast iron split clamps serve as mud anchors for underwater sections of the pipeline at stream crossings.

On the rest of the project access to the pipeline was easy, either by the Alaska Highway or the railroad. The pipe follows the road, though some supplemental clearing for the pipeline right-of-way was necessary.

Pipe laid with welded joints

Pipelaying procedure was substantially the same for all sections of the project. The pipe, ranging from 2-in. to 6-in. diameter, was received in 30-ft. and 40-ft. lengths, all with beveled cut ends. Except for stream crossings, all the pipe was laid on top of the ground, following all major irregularities in the terrain, but spanning over minor undulations. Seldom was any blocking or other support used. All joints were welded, forming a solid, continuous line without flexible joints. Expansion and contraction due to temperature changes were taken care of by the way the pipe was laid, winding and weaving over humps and hollows and around large trees and rocks. Streams were crossed in two ways, either on highway bridges or special trestles, or with the pipe laid on the river-bed. The latter method was preferred, and in case of larger rivers, special mud anchors were installed in the line in order to hold the pipe in place against the strong current.

No grading was done in preparing the right-of-way for the pipeline. If the edge of the highway clearing could not be used, a bulldozer merely slashed out a width of 8 ft. or so through the trees and brush. Pipe sections were delivered on long trailers. If possible, the pipe lengths were strung out as they were unloaded, otherwise they were piled up for stringing out by hand later.

After stringing, the next operation was tack-welding the joints into a continuous pipeline. First, adjacent sections were held together by a quick-operating open clamp. Then a tractor with a side-boom crane would hold the clamped joint off the ground while a welder tacked the sections together, after which the clamps were removed. The crane then lowered the sections onto blocks about 2 ft. high. Following close behind the head end crew were the final welding crews, who completed the welded joint in two passes. As the pipe could not be rolled, the welders had to lie flat on their backs to get at the under side of the joint. This is not a pleasant task, for often the ground was swampy and mosquitoes were particularly bad in the freshly disturbed brush. Then the welds were peened or hammered with a hand hammer to relieve the locked-up welding stresses, and finally the completed pipe was lifted off the blocks by another tractor crane and

the pipelaying operations were completed.

All welding was by portable electric arc welding machines, driven by gas engines, and mounted on small trucks, sleds or carts, the latter two usually dragged along by the tractor crane. Long cables enabled the welders to work several joints without moving the machines. After a long section of the pipe was complete it was then tested for leaks with compressed air.

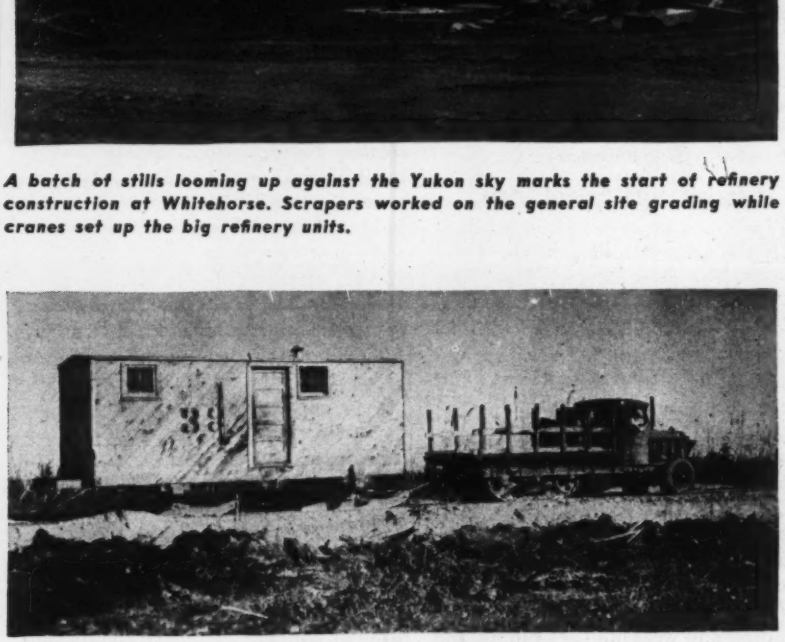
Where the pipe crosses streams on the bottom, the usual procedure was to weld up the required length on shore, then pull the pipe across the river with cables attached to tractors on the other side. Considerable difficulty was encountered in crossing the Mackenzie River. Although the river is nearly four miles wide at Norman Wells, the pipeline crosses to an island, then to the opposite shore. Sections were fabricated on a wharf, and the leading end was carried out on a barge which was pulled across the river, with the pipe trailing behind, by a tugboat assisted by a hoist on the island. Examination of the line after laying in the river bed revealed several bad kinks caused by the current. The damaged lengths were raised out of the water and replaced by welders working on barges.

The biggest job in connection with the refinery was transporting the large sections over the narrow-gage railroad from Skagway to Whitehorse, and other large sections, mounted on the small cars, cleared tunnels and snowsheds. It necessary to blast out several points along Lake Bennett to get longer sections, loaded on two around the sharp curves. Once reached Whitehorse, erection of refinery sections was routine construction with large cranes.

Project camps were built for rigors of the north country. In Mackenzie River territory log were often used, especially by troops. Many insulated metal were also erected at base camps. the crude oil pipeline section, camps were simply wanigans, or able bunkhouses and mess mounted on sleds dragged along trucks or tractors to keep up with crews. Because of lack of refrigerated storage on the boats and barges, meat was taken down the Mackenzie on the hoof, and butchered at camps. Cattle, hogs, sheep, live poultry, feed for the livestock, men, knocked-down camp buildings construction equipment made a conglomerated cargo.

With Canol completed, the and its troops, the engineers, contractors and civilian workmen can all pride in accomplishing another standing construction achievement the Arctic under the worst conditions of terrain, weather, isolation, supply and construction difficulties. Canol now ready to contribute vital oil gasoline to the war. Then, too, someday it may become highly important as the world's oil supply dwindles is certain to be the forerunner future oil developments in northern Canada and Alaska.

A batch of stills looming up against the Yukon sky marks the start of refinery construction at Whitehorse. Scrapers worked on the general site grading while cranes set up the big refinery units.



Portable bunkhouses or wanigans and gasoline supply tanks were both mounted on sled runners for tractor and truck haul to head-end camps on the pioneer road construction.

Direction under army engineers

All developments, construction operation of the project were under the direction of the army engineers who set up headquarters at Edmonton. At first, Col. Theodore Wyman in charge and he was succeeded April, 1943, by Brig. Gen. L. D. Wesham. While the army was in general charge, all engineering was handled by a combination of J. Gordon Turnbull, of Cleveland, and Sverdrup & Parcel of St. Louis, acting as consulting engineers. Contract for all construction was awarded to Bechtel-Price-Callahan, a combination of California contractors.

A Seabee and His Duck at Salerno

Jack Hamilton Prickett
54th Naval Construction Battalion

The following story was told to a representative of GMC Truck & Coach, Division of General Motors Corp., builders of the "Duck", by the author, a hydraulic engineer for 14 years before joining the Seabees—The Editors

I HAPPENED TO BE HEADING FOR beach at Salerno in an amphibian k, commonly called a "Duck," an ahead of the British invasion e is a long story. It goes back to rte where my outfit of Seabees was ilding that port after its capture. he Army had many units that badly in need of practice in ing landings, such as they were to make at Sicily and in Italy. It our job to find such North Afri- beaches as would be suitable for tice landings, and chart their nels, shoals and bars. Knowledge ese things is essential in order to d unnecessary loss of men and erials.

ur original detachment had a and five men, which constituted rvey party. Later, it was expanded ree ensigns and twelve men. We ed our investigations with small , making hand soundings with leads, but this method did not prove very satisfactory. Finally, we persuaded our commanding officer to let us try the job with Ducks, using sonic depth sounding devices. Then, we really began to get good results. In fact, the results were so good, and could be obtained so quickly, that we suggested to our superiors that Ducks be used to precede the first shore parties in the Italian invasion and chart the landing beaches in the same way. Our suggestion was accepted and first put into practice in Sicily.

Duck saves lives

In the pitch black of a windy night off Gela, men in the Beach Battalion rolled off the ramp of an LST, and drove their Duck through waves ten feet high. Here's the story as they told it: In an unbelievable short space of time, they were able to chart the channels and set up markers. One of the ensigns had discovered something, too, that may have saved many a soldier from drowning that night. One hundred and fifty yards from shore their Duck ran up on a sand bar with only two feet of water over it. But almost immediately it plunged into deep water again—at a depth of eight to ten feet! If the landing boats had unloaded on that bar, and the boys had started to wade ashore, undoubtedly many of them would have lost their lives.

For those first two days at Gela, it was touch and go whether the landing was going to be successful or not, because there was a reception committee of three German motorized divisions, and a lot of German aircraft as well, waiting for us.

Success in a landing such as this is to get every man and all the materials ashore fast. Our Ducks proved most effective in accomplishing this

U. S. Army Signal Corps photo

In the thick of the fight for Salerno beach head, Ducks were effectively used for transporting supplies from ship-to-shore to-firing line. On return trips the wounded were evacuated to first-aid stations and hospital ships.

purpose. We could go out to a ship, get a load of ammunition and head back for the shore. But we didn't have to unload our ammunition on the beach like the boats did—we took it right up to the firing line.

Perhaps you think I am too enthusiastic about these Ducks. Perhaps, but their performance had attracted the attention of a lot of conservatively minded people. The British, for instance, had watched them closely, and shortly before the invasion of Italy preparations were made to use Ducks operated by a small detachment of Navy personnel, which included men from the Beach Battalion and myself.

Crew asked for it

Our task was to chart the beaches at Salerno for LST landings and we were ordered to report to the commanding officer of the British force. I was the only enlisted man to attend this meeting along with our Beach Battalion officers and Amphibious Staff Force. Here we studied the maps and got a thorough picture of the intended mission with all its ramifications. Now we learned why the British had observed our preliminary operations so closely .

Before we left headquarters, the British Task Force Commander asked us, "Did you men volunteer for this undertaking? Do you believe that your Ducks can do the job of checking and charting the beaches?" Speaking for myself, I was willing to try it, and I knew the other five in our party felt the same way. That is how our three Ducks came to leave the British LCT boats in the black of night an hour before "D" day at Salerno.

Although the night was all black as pitch, fortunately, the sea was calm. We made our survey without difficulty and found both beaches perfect for the landing boats. We started back to the LCI where the British commander apparently had received information that made it necessary to order the attack at once. The British naval units began to lay down a terrific barrage on the shore and the Germans immediately opened up from their position. We were caught in the middle of this terrific cross fire with our three Ducks.

We passed the assault craft going in as we made our way back to the LCI to make our report. Following our report to the Beach Master, we then turned our Ducks around and followed the LCI, with the commander of the task force aboard, to the beach. Our party assisted the Beach Battalion in setting up the command post and digging foxholes.

It's impossible to begin to put into words what that Salerno beach was really like that morning. Behind the sandy shore there were orchards that were a tangle of trees and vines, with cane-brakes at the edges. Machine gun and rifle fire came from this ideal cover, and from the hills the big shells from the German 88's were coming every minute. The beach had been so heavily mined it took a long time for the sappers with their detecting devices to clear a safe path for the tanks that managed to get ashore.

From ship-to-shore-to-firing line

The tanks had landed on the beach across the river from the command post. Presently a runner came to the post, bringing word that the tanks were desperately short of ammunition. Offshore was an LCT boat loaded with ammunition, which had been hit and was burning. The Beach Battalion commander asked if we could salvage a load of ammunition from this burning vessel and get it to the tanks.

Fire was threatening to get into the ammunition when we reached the ship, but we managed to recover five hundred rounds of 75-mm. shells and make it back to the shore. With the

r who had come from the tanks guide, we set out to find them. British had driven back the Ger- a little way by this time so we able to drive right into the rd. I am sure that being able to our "Ducks" clear of the roads ay in the cover of the trees was t saved us from enemy-attack. wever, we couldn't find the . Finally we halted, camouflaged Duck as well as we could with hes, and I took a tommy gun et out in search of the tank force. walking about half a mile, I them. I'll never forget the sur- look on that English comman- face. The sight of a lone Seabee ing on foot was too much for He even asked me for my identi- on card. He could hardly believe n I told him I had a load of am- tion hid in the orchard. We got the stuff up to the tanks. hen we returned to the command there was another job waiting s. About a mile and a half off- was a disabled LCT boat, loaded supplies. It was up to us to bring to the beach. After securing it our winch line, we then used Duck's engine to operate both pro- and winch, and succeeded in g the LCT. When we reached the , we locked the wheels, and used inch to pull the vessel the rest way. This boat was 110 ft. long, he Duck brought it in safely.

Two way traffic

r the next five nights we carried each way—supplies up to the lines and wounded men back e beaches. We could carry eight cher cases inside and half a dozen tly wounded men on the front of Duck. The battle swayed back and with attack and counterattack. lly, we received some air support he Germans were driven back. the fifth day, several Liberty came up loaded with cargoes had expected to deliver in the of Salerno. But Salerno was still cene of bitter fighting, with the frequently changing hands. It imperative to get the cargoes re. Just south of Salerno there ed to be a chance. High cliffs g the shore, it was thought, would the ships protection from Ger- artillery back in the hills, and was a narrow beach where muni- might be landed.

The Beach Battalions were asked to use one of their Ducks to investigate the beach and the possibilities of such a landing. Everyone knew the beach was full of hidden mines, but it was believed they could be located. Probably they could have been had there been time to do the job. It was soon discovered, however, that the Germans had thought of everything. High-angle mortars had been set up, and the Germans began dropping shells on the beach; the cliffs afforded no protection whatever against them, and our boys had to get out.

When the Duck was whirled around a sand dune a vehicle mine exploded under the left rear wheel. At this moment a machinist mate, was sitting on the radiator on the right front side of the Duck, carrying a tommy gun and watching for snipers. The explosion virtually tore off the rear end of the machine. Although the driver was partly protected by the metal back of the seat, he suffered severe head and shoulder wounds. The machinist mate landed in the sand on his back 25 ft. away with his left arm doubled up under him. Members of a British artillery battery near by heard the explosion and came to do what they could for him. He was later taken to a field hospital.

This all took place about noon while my crew and Duck were handling supplies further south. In the meantime, the third Duck got a direct hit from an 88-mm. German shell.

Home at last

Fortunately, our luck held out and we were on the Salerno Beach for ten days, after which we returned to Bizerte. There, I continued to teach crews of Beach Battalions until October, when I returned to the 54th Battalion, and then home in December.

Ducks did not have to stop to unload on the beaches. Shifting sand dunes presented a huge problem in keeping ammunition moving from the ships to front line batteries but the Ducks were able to navigate through it.

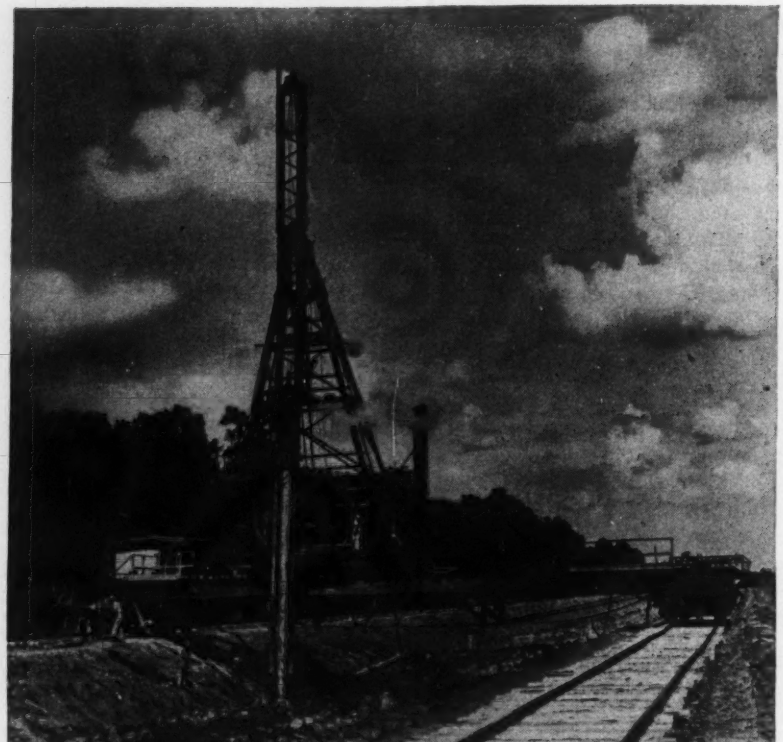


Fig. 1. The pile-driver traveled trans**versely on carriage** and its lead **swiveled at top of frame** to drive piles **battered in any direction.**

Traveling Gantrys Build Railroad Trestle

***Contents in Brief**—A 19,000-ft. concrete bent and girder railroad trestle over alluvial silt of a floodway was built from traveling gantrys spanning the entire work and moving on rails laid on embankments made from the footing excavation. Duplication of supports and spans throughout the 3½-mile length made possible 600 repetitive operations for which the contractor planned and shop-built all of the equipment and forms required for the project, thus achieving unusually low costs.*

CAREFUL AND BOLD PLANNING of construction plant for a 3½-mi. concrete bent and girder railroad bridge over a floodway on the alluvial delta of a river in the South resulted in unusually low labor cost.

For example, wood piles, despite batter in every direction, were driven for a labor cost of less than five cents per linear foot. And footing, column and girder forms of steel, job-shop made, were placed and stripped for about seven cents per square foot for labor; concrete was mixed and handled at a correspondingly low figure. Exact duplication of spans in the original design and a thoroughly planned construction plant to take advantage of the duplication were the major factors in keeping the cost low.

The bridge is over the Atchafalaya floodway built and maintained by the Corps of Engineers U. S. Army and this agency financed and provided over-all supervision of inspection for the project. The design was prepare by the railroad that is using th bridge. The Army Engineers previ ously had specified that the bridg should be a structure similar to wh the railroad would design if it wer paying for the structure. Fire protec tion provisions, due to dense fores and undergrowth along the right-o way, and a permanent type structur were expected, but unusually con servative designs or other costl features would not be approved. Main tenance of the bridge under service i the responsibility of the railroad.

The completed structure is a singl track 19,000-ft. trestle designed fo Coopers E-60 loading. It consists o 590 similar concrete bents and abou 20 special bents supporting concret girder deck spans, each 31 ft. 3 in long. Typical bents are A-frames sup ported on 24-ft. wood piles, capped with a concrete footing and varying in height from 22½ to 28 ft. from to of footing to top of cap. Some spe cial bents are supported on steel she piling about 90 ft. long, which were driven 10 ft. into a firm sand and then filled with concrete. Anchor and special bents consist of double A frames with horizontal concrete tie just below the ground line.

Legs of the bents batter 1½ in. outward but maintain a constant thick ness in this direction of 27 in. Longi tudinally the column legs widen by $\frac{5}{16}$ in. per foot on each side. Two 32-in. wide concrete girders are poured integrally with an 11 to 12 in slab to make a total depth of about 4 ft. for the concrete beam. The deck has curbs to retain ballast for support of the ties and rail with an inspection walk along one side for its full length.

A 3,000-lb. concrete was specified with a working stress of 1,000 psi and a reinforcing steel stress of 18,000 to 20,000 psi.

Construction plan

The area crossed by the bridge is lowland that often has water standing on it; it is expected that it will be used as a floodway only infrequently. The entire site is so swampy that it is in accessible to usual hauling units.

an selected for construction was cavate a continuous trench for footings using the material to an embankment for temporary ard-gage track for rail handling ll equipment and material for truction. Excavation was done by lines working on long mats and material was formed into a dike 4 ft. high to keep water out of xcavation as well as making the nkment. A line of track was laid ach side of the trench, 75 ft. c., to serve as support for con- tion equipment specially built an the work. On one side of the vation an extra track was added rvice the job by rail, frequent overs being provided to use the track for passing and for work

e excavated muck made a very surface for support of the tem- y railway and considerable dif- y was experienced in maintain- track. Ties were placed side by along the full length of the track, of them up to 12 ft. long. After attempts in the early stages of work to hold the track, the con- or raised the entire line 6 in. by ng sand and gravel dry with one of portland cement per cubic and tamping the mixture under ties. Water from the subgrade sufficient for hydration of the nt and subsequent hardening stabilized the track to such an extent that maintenance of way was cut to about one-tenth of that formerly required.

Unique pile-driving rig

There are twelve timber piles under each of the two legs of a typical bent, all of which are battered from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. per foot outward to increase the area of soil over which the load is distributed and to resist the longitudinal and lateral forces. Driving 739,000 lin. ft. of piling, some 14,000 pieces, 50 and 60 ft. long, all on a batter, constituted a very unusual driving job and dictated the design of a unique bridge to rapidly move and position the pile-driver.

The rig used was designed by the contractor's forces and built in a job shop for less than $10,000. It spanned the trench and moved on two pairs of car trucks at each end, traveling under its own power. The carriage was moved ahead or back on the track by a long shaft and gear arrangement, with diamond chain and sprocket used to transmit the driving force to the traveling wheels.

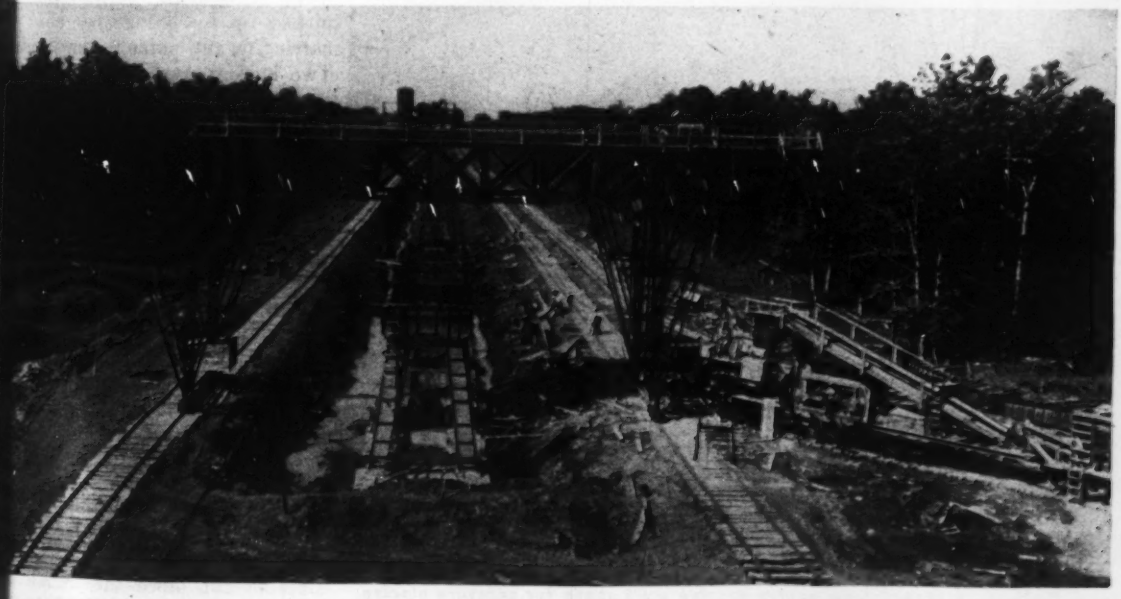
The driver unit was powered to move longitudinally across the frame to any desired position, a single pair of leads being used for the driving. The leads, 75 ft. long, had a ball and socket joint about 18 ft. below their tops to permit swing either longitudinally or transversely. Three hand-powered hoists, with lines made endless, were used to swing the leads to any desired position for batter. The leads then were made fast by pins through slots. A steam boiler, mounted on the rig, furnished power for the hammer and for the traveling engine.

Seven men drive 100 piles in 8 hr.

Piles were brought to the rig by rail and unloaded from the cars by a line from the driver that swung them directly into the leads. One crew of five men with a foreman and operator drove all of the piling in the job at an average of 89.4 piles in an 8-hr. shift. Top day was 135 piles and the average was more than 100 a day for a two-months period. In nearly all cases piles were driven to the desired elevation, but a minimum cut-off was required to secure bearing on good wood.

Piles had a minimum tip diameter of 8 in. and were of 16 to 18-in. dia. at the butt. Soil generally was a reddish clay with the upper 15 to 20 ft. quite soft. In some areas sand pockets 1 to 4 ft. thick were encountered at depths of 15 to 45 ft. and in other places cypress stumps a few feet under the surface added to the difficulties of the driving. A minimum bearing of 15 tons was obtained.

During the period that driving and footing construction was under way



2. The concrete railroad trestle was built with gantrys spanning the construction area and with concrete supplied a rail-mounted mixer fed by conveyor from batch boxes on a car behind the mixer.

in a particular section the area was blocked off by small earth dams and the water, which normally filled the ditch was removed by pumps.

Following the same type of planning that produced the unique driver, the construction forces designed and built two unusual gantries for moving forms and for mixing and placing concrete. These rigs spanned the 75 ft. between tracks and were built with enough clearance to carry a concrete bucket over the highest part of the structure. The gantries each had four trusses, in pairs of two, extending the full width of the trench with one end of the trusses cantilevered so that material could be picked up from railroad cars on the hauling track.

Between the pairs of trusses and on top of the gantry a triple-drum, gasoline-powered hoist mounted on trucks and rails moved itself back and forth transversely to the line of the bridge. One drum of the hoist moved this unit, using an endless line, while lines on the other drums lifted buckets of concrete, moved forms or placed reinforcing. A separate, automotive type, replacement engine supplied power for moving the entire carriage along the line of the rails working through a speed-reducing bevel gear on a long shaft. A roller-chain from this shaft to a sprocket on the driving wheels transmitted power to the wheels. In addition to the main lifting device on the gantry there were four hand-winches mounted on small frames on wheels that could be moved by hand along light gage rails transversely on the frame.

Fig. 3. In plan the form shown is L-shaped, a matching half completing the four sides of the legs.

Two of these rigs, designed and built by the contractor's forces, were used for all work on the job except the pile driving. They were constructed in a field shop at a cost of less than $8,000 each.

The concrete plant was entirely rail-car mounted with a 1-cu. yd. mixer, fed by dry batch, delivering concrete directly to buckets under the gantry. Concrete materials were batched from a rail-side plant to standard flat cars especially equipped with dry batch boxes, 15 to a car, and carrying sand and gravel together and cement in a separate water-tight compartment. The batch boxes were arranged to dump through the bottom of the car to a belt conveyor that carried the material forward and discharged it on another belt that fed through a hopper to the mixer.

Actual operation kept one car continually at the mixer for use while shifting cars, a second batch car discharging on the belt of the first and passing under it to feed the belt on the mixer car for normal work. Gasoline-powered locomotives hauled the cars from the batch plant to the point of placing.

The mixer and batch cars were spotted on the track on which the gantry operated, trailing the gantry and delivering concrete to a bottom dump single-line bucket that was picked up by the gantry hoist as carried to any point in the structure. Two buckets were kept in operation, one being filled as the other was carried out for discharge. Small, flanged wheels attached to the bottom of the buckets and a rail arrangement in front of the mixer made it possible to set the empty bucket down away from the mixer and pick up the filled bucket with the hoist. A man then placed the empty bucket under the mixer discharge for filling while the first bucket discharged its load.

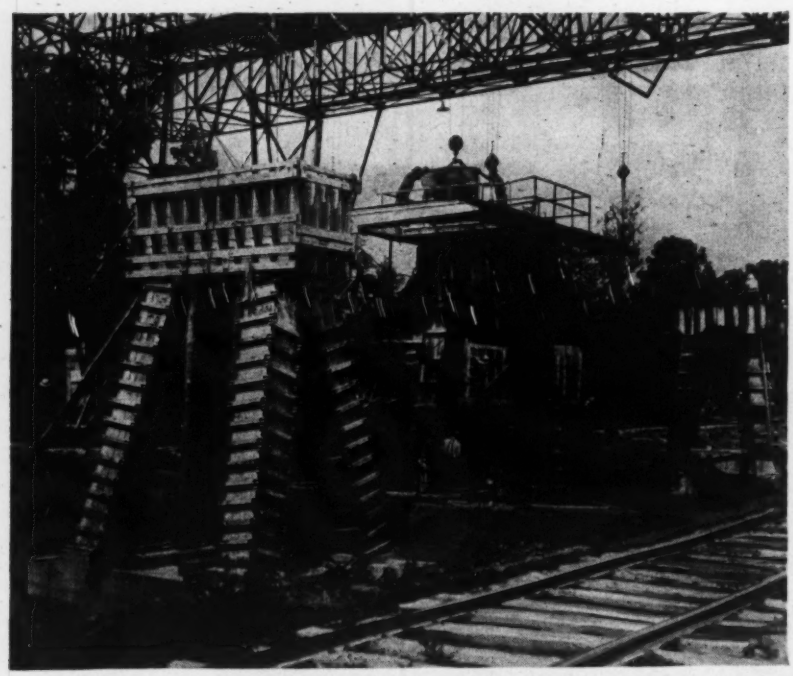


Fig. 4. Platform suspended from gantry provide work space for concrete placing. A telescoping tremie pipe extended into each column leg from hopper under platform to assure placing concrete without segregation.

Job-designed steel forms

The large number of duplications possible in this bridge made it desirable to use steel forms; and the number of times the forms would be handled made it economical to utilize the greatest labor saving devices possible to cut down the overall cost. The forms were well built and braced and were equipped in all cases with

acting bolts and connecting de- equiring a minimum of skilled nd time for their erection. Six f footing forms, 14 sets of ed column and cap forms and s of deck forms were built by ntractor in his own job shop. ms for the footings and for the were made in two "L"-shaped that could be rapidly bolted only two of the corners. The r the bent was built integrally he column legs and placed with s may be seen in Fig. 3. Rein- g steel for footings and for the ns was assembled into cages at ral yard and transported by rail point of placing and set from aveling carriage.

crete for the footings was directly from the bottom-dump t. Specifications did not permit ing the concrete in the columns than 30-in., so two hoppers and pipe extending into the column were used. A frame was sus- d from the hand winch cars of ntry to provide a work platform top of the columns for placing te and the hoppers and tremie ttached to them. Under the r, a 6-in. dia. tremie pipe fed a telescoping 8-in. dia. pipe was adjustable for height. A e shaft vibrator was lowered gh the tremie pipe to vibrate the te in the columns. The 8-in. was raised, as concreting pro- d, by a winch attached to the r. As the concrete neared the e entire platform, with hoppers, aised to permit completion of eting of the bent.

er the columns were filled speci- ns required that an hour be al- for settlement of the concrete e columns before placing of p. During this period reinforc- r the cap was set in position and d. Anchor bolts for shoes sup- g the girder spans were rigidly n position by templates integral he forms. Seats for the bear- were cast slightly high and, after ning, were bush-hammered and undum rubbed to accurate ion.

k forms were placed for alter- pans and these were filled and d to cure from seven to four- ays, depending on the weather, the intermediate spans were . The forms used were all in iece for the full width of the

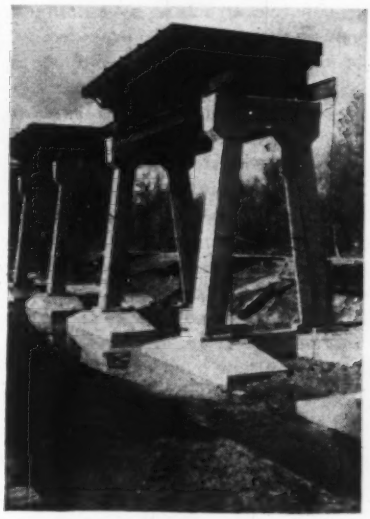


Fig. 5. Forms for each 31-ft. girder were carried on longitudinal beams which in turn were supported by short, rocker-mounted cantilever beams. These could be adjusted by a turnbuckle on the hold-down rods, shown right center.

concrete deck and were stripped by springing them slightly to loosen them from the beams, the latter having a slight "draw" to aid in stripping.

During pouring the form was supported on two longitudinal beams spanning the 29 ft. between bents. Actual load on the beams was taken by plates linked to a cantilever hanger laid over the top of the bent. The outer end of the hanger was tied to the footing with rods made adjustable by a turnbuckle. These rods could be adjusted to accurately position the form while other turnbuckles provided some lateral movement and held the form exactly in position.

The deck forms were moved and set as a unit, two of the five transverse beams under the forms extending out beyond the sidewalk and curb overhang to permit attachment of lifting lines from the winches above. A short section at each end of the form, cut on a diagonal, was made easily detachable to permit stripping the center section in one piece and subsequent removal of end sections by hand.

Reinforcing for the girders was preassembled into a rigid cage. Overhang of the gantry frame permitted picking up the reinforcing steel from a railway car and lifting it into position in the form in one operation. Spacer blocks of concrete were already in place on the reinforcing steel to speed the operation.

Concrete placing was started at one end of the form and continued across

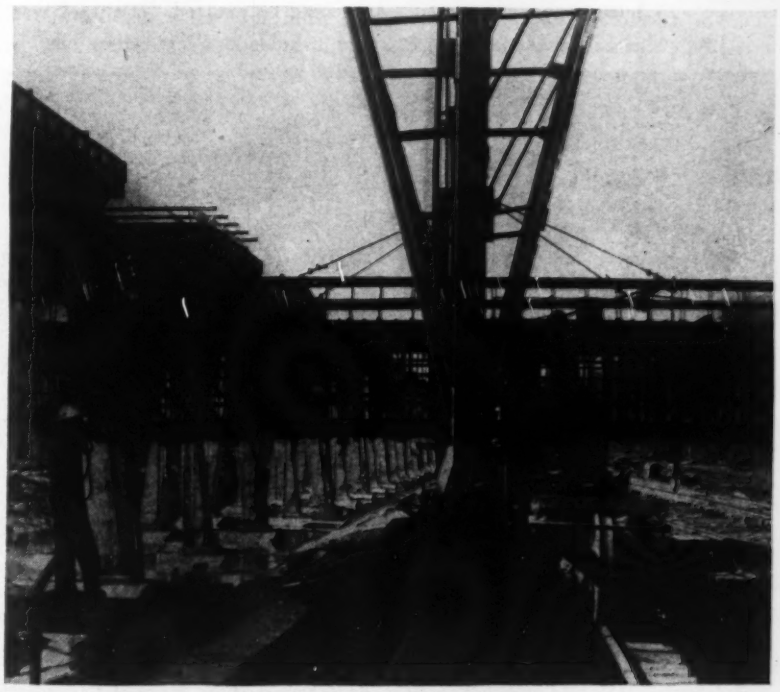


Fig. 6. Gantry sets preassembled reinforcing steel for entire girder. Note concrete spacer blocks already attached to bottom of steel.

its full length, the mixer plant moving ahead with the gantry as placing proceeded. Flexible shaft vibrators settled the concrete into the forms. An 11-ft. dia. steel screed ring was suspended from overhead cross beams on the form and centered successively over each of the drainage outlets. A float was arranged with one end to fit the drain pipe and the other to ride the screed ring. As the float was swung around, the excess water and soft material from the screeding operation flowed to the center and was allowed to escape down the drain, thus giving quick and accurate finishing with an assured slope to the drain.

Removal and moving of the deck forms was started by suspending, from lines attached to each of the four hand winches, two 24-in. deep I-beams, whose length was more than twice the width of the deck forms. The 24-in. beams were brought up to just below the longitudinal beams which carried the load during placing, and the cantilever hangers released, lowering these beams to the top of the long transverse ones. Next, the form was sprung slightly and pulled off the bottom of the deck and the entire unit lowered sufficiently to clear the permanent structure.

The separate end sections of the forms were laid on top of this form and the unit pushed to one side of the concrete structure by simultaneously moving, on rails provided for the purpose, the carriages supporting the four hand winches. When clear of the concrete structure the form unit was connected to six lines suspended from the gantry frame while the 24-in. beams and the smaller longitudinal beams were lowered to the ground. The longitudinal beams then were carried ahead to be set in place to support another form and the form unit itself was moved ahead, on the gantry, and reassembled for setting it in a new location.

Low unit costs

The project, costing about $115 per lin. ft. of trestle, not including ballast, ties or track, illustrates the economies of multiple span design. The structure was completely planned and field work well advanced before the U. S. entered the war and steel shortages developed. However, the design was acceptable under conservation regulations and the structure has been completed so that the floodway it crosses is usable without disrupting rail traffic.

Fully as important to economy as the simple, multiple design of the permanent structure was the carefully planned contractors plant. In this case a very large investment was necessary before any return from the job could be realized. The track was in place for the full length of project, the pile driver and the se gantry bridges were erected, the crete placing rig and several se forms all were ready before an the equipment except the d could be really tested. Judgme the job forces was fully vindi however, by the rapid and repe set-up that enabled completion o project six months ahead of sch despite working one 8-hr. shift.

Personnel

The bridge was constructed fo New Orleans, Texas and Mexico R road with design and constru handled by the Gulf Coast L offices of the Missouri Pacific Sy of which the N.O.T. & M. is a sidiary. C. S. Kirkpatrick, chief neer; Roscoe Owens, constru engineer, and Lee Mayfield, field gineer, represented the railroad.

Brown & Root, Inc., of Hou Texas, built the crossing und $2,198,000 contract that incl driving of more than 750,000 ft. of piling and placing 50,000 c of concrete. Personnel of the tracting firm were Herman Br and George Brown, partners; White, vice president; J. E. W general superintendent; M. P. A son, chief engineer; E. R. Bre field superintendent, and J. R. M assistant superintendent.

Fig. 7. Forms for intermediate girder spans also were supported by cantilever beams to facilitate stripping the

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James J. Lucy,
General Agent for Maryland Casualty Co.

***Contents in Brief**—Troubled financial waters are seen ahead for general contractors and subcontractors alike if they do not safeguard their credits and if they do not aid in stabilizing the construction industry. Stabilization is possible if contractors and all related organizations examine more closely the financial condition of their customers, give more study to preparation of financial reports, use more extensively the payment bond, and make use of the reliable contract information obtainable gratis from the Bureau of Credit Information.*

DESPITE THE WIDESPREAD CREDIT RISK in the construction industry, rarely do creditors in the industry apply sufficient foresight in avoiding the credit losses that invariably come with recessions in construction volume. The present is no exception.

In recent years, the volume of war construction so taxed the capacity of the industry that there was not only a great increase in the number of contractors operating, but the volume handled by individual firms greatly exceeded their peace-time performance. Profits were large and overhead costs were expanded far beyond ordinary needs. Though the aggregate construction volume steadily dropped during 1943, not until late in the year did contractors begin to suffer from overhead costs exceeding current net earnings. When taxes on war income are finally paid and after refunds of excessive profits are made through renegotiation of completed contracts, the effect of the present situation on bank balances will be quite noticeable. Building construction is most sensitive to "depressions" and the effect of the substantial reduction of war construction, together with the limitations imposed by our war economy through priority controls and such, is expected to create a rather "depressed" state of affairs for the duration of the war. Inflationary influences, tending to increase costs, will further unsettle prospects for the future. The productivity of the available labor will be lessened, particularly among unskilled workers, and actual labor costs will continue to exceed published minimum wage rates in those areas where construction is still needed. Material costs must likewise rise under the influence of renewed pressure for higher wages in industry as living costs and taxes are increased.

Organizations expanded

Contractors who have, for the purpose of carrying out their war contracts, built large organizations of competent but expensive personnel will be reluctant to reduce these organizations to pre-war size, lest they thereby limit their ability to obtain some of the few important contracts still to be awarded. These contractors will also be unwilling to re-enter the "small" contract field until necessity forces them to do so, when they may find the small contracts reservoir preempted by the newer and often less responsible contractors equally hard-pressed to obtain work.

Contract prices will probably be on a cost-plus-overhead basis with labor and materials continuing to rise during the remainder of the war period. Owners will have, comparatively, more time and men for careful inspection and supervision. As a result, performance requirements will be increased with a corresponding rise in the cost of field supervision by contractors and subcontractors alike.

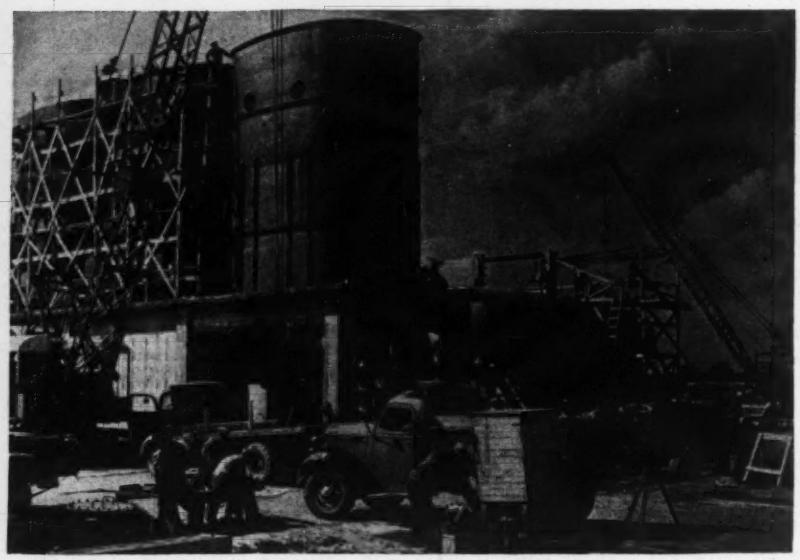
These circumstances will ultimately result in the "survival of the fittest." But the elimination of the less qualified contractors will entail substantial credit losses because of the extent to which all such operations will be financed on credit with little, if any, profit-margin for safety. All creditors in the construction industry, from the general contractor back to the manufacturer or producer of materials, should examine the credit standing of their customers with extreme care or otherwise be assured of ultimate payment for their work.

Moral responsibility, or what is called character or integrity, is the cornerstone of all credit. No amount of financial responsibility or ability can adequately compensate for the lack of integrity. The construction industry has been somewhat negligent in observing this rule in determining a customer's eligibility for credit and the contagion often extends to bankers and bonding underwriters. Credit losses are as frequently caused by dishonesty as by incompetence or lack of financial worth. Since a corporation merely borrows the ability and integrity of its officers and stockholders, the moral responsibility of these individuals should be determined.

Ability is the product of experience

HELP FOR OWNERS

From the Bureau of Contract Information, Inc., 1420 New York Ave., N.W., Washington, D. C., factual data may be obtained concerning contractors throughout the United States. The bureau will supply information free of charge relating to contractor's performance records, reliability, personnel, and bonding.



Construction projects with their multitude of individual interest present complex problems in business management. In particular, great care must be exercised to provide financial protection for the owners, the general contractor, the numerous subcontractors and those firms supplying building materials.

and training, but deficiencies in the ability of a contractor's organization can be supplied by the employment of competent personnel to supervise the performance of a contract.

Financial responsibility is a necessary requirement, but the sufficiency of such financial responsibility is dependent upon collateral circumstances, such as the volume of work on hand and the type of contract undertaken. An honest, capable contractor would be a better credit risk with less capital than a less experienced or less reliable contractor with more capital. If capital has been steadily accumulated by successful operations conducted over a period of years, it is entitled to greater consideration than newly invested capital of even a greater amount. Capital acquired through years of work is not likely to be risked in speculation.

When financial statements are required or furnished they should preferably be prepared by certified public accountants in such detail as to disclose the debtor's complete financial position. A firm possessing a sound financial condition should not hesitate to boast of this condition. The more completely a good financial condition is evidenced, the greater the benefit to the debtor.

Confirmation of the foregoing qualifications is the ultimate in credit investigation. The fact that losses still occur when all of these circumstances are favorable suggests the need of some greater protection in order to stabilize the building industry. That added factor is the payment bond. Claims for non-payment of bills on war construction throughout the country are now flooding the claim offices of bonding companies. These bills would represent losses to trade creditors aggregating well into seven figures but for the payment bonds that alone assure to creditors of defaulting contractors payment of their just claims.

Separate payment bonds

Prior to 1929, surety underwriters and their customers placed greater emphasis on performance of the work than on payment of bills, though a guarantee of payment for labor and materials was usually included in performance bonds. As a result of the depression many subcontractors and materialmen found that the owner's prior claim frequently lessened the value of the payment guarantee. Through the efforts of the National Association of Credit Men and other credit organizations in the building trades, the Miller Act, providing separate performance and payment bonds on federal construction, was enacted by Congress in 1935.

Since that time surety companies have consistently recommended the use of a separate payment bond with direct right of action by the creditors, as a convenient and effective means of guaranteeing to owners and creditors alike, that the general contractor will pay his obligations incurred in performing the contract. A more general use of the payment bond on public and private work, in addition to the usual performance bond, will be an important contribution toward stabilizing the construction industry. This benefit will occur not merely by imposing a financial penalty on a surety that fails to verify a contractor's payment record, but in reducing the cost of construction by eliminating credit losses to subcontractors and materialmen thus relieved of the need of providing for such contingencies in their aggregate contract price.

Sub-contractors should be bonded

The payment bond under the Miller Act protects materialmen, laborers and subcontractors of the general contractor and similar creditors of subcontractors but, unfortunately, the term "subcontractor" does not include materialmen or others who do not deal directly with the general contractor or the latter's subcontractors. General contractors must be assured of protection against having to pay for the same work two or more times, or against the default of their direct creditors, which likewise is most satisfactorily done by requiring their subcontractors to furnish surety bonds in favor of the general contractor.

Surety bonds provide protection against the consequences of human errors of judgment, normal hazards of the construction business and dishonesty. But owners and prospective creditors of general contractors must, of necessity, exercise discretion in judging the basic qualifications of general contractors with whom they do business. Competent and reliable sources of information upon which to base such judgment are available both to owners and members of the building trades.

Help is available

The Bureau of Contract Information, Inc., 1420 New York Ave., N.W. Washington, D. C., is a non-profit organization organized in 1929 through cooperation of the bonding business and the construction industry. Its purpose is to make available to awarding officials, both public and private, and

ir architects and engineers, trust-rthy factual data on contractors oughout the United States. These orts cover:

Performance records: Types and ounts of contracts completed, indi-ing the class of work the contrac-is competent to perform by ex-rience.

Reliability: Record in performing rk and in discharging his obli-ions in connection therewith.

Personnel: History of partners or icers. Usually disclosing any previ-s association with a defaulting con-ctor.

Financial condition: Not including ancial statements, but showing the ility of contractor to finance con-cts from his accumulated resources d credit standing with banks and de sources.

Bonding record: Past performance fulfilling responsibilities under rety bonds.

Special investigations: Of bidder's alifications to perform work for hich proposals may be pending ard.

Reports from the Bureau of Con-ct Information may be obtained by ners and their architects and engi-ers, upon request, without charge or ligation. This service has been of stimable value to awarding officials both public and private work for past fourteen years, particularly in wartime emergency.

The most satisfactory sources of edit information available to sub-ntractors and materials men are riendly" sources, such as banks, nding companies and local credit sociations affiliated with building de organizations. Such sources intain extensive facilities for in-stigation and reporting of informa-n pertaining to the record and qual-cations of general contractors lo-ted throughout the country. Their perience in interpreting the facts sclosed by their investigations is kely to be of value to their custom-s. Subcontractors and materials men ould more consistently check the sponsibility of their prospective btors, and they should cooperate furnishing as much information as ey may possess concerning the own-ship, management and history of customer, so that these facts may rticularly be investigated and veri-d.

Some surety underwriters regularly check the relations of their general contractor clients with all of the subcontractors used on completed contracts. This practice has been of great value in demonstrating the superiority of some contractors' business methods over those of some competitors—to the benefit of those contractors thus shown to be more deserving of confidence. If trade creditors would cooperate with general contractors who earn their favor by full and prompt observance of contract obligations, and if credit investigations invariably included a complete check of the experience of all subcontractors and materials men with the general contractors for whom they work, many of the objectionable practices in the construction industry would be eliminated and present and future credit risks considerably improved.

Court Ruling Clarifies Definition Of Subcontractor on Federal Work

The U. S. Supreme Court, on April 24, found that a person supplying materials to a materialman on a government contract cannot recover on the payment bond executed by the prime contractor the amount owed him by the materialman. The court made this finding with respect to a suit brought to recover under the provisions of the Miller Act, passed by Congress on Aug. 24, 1935, to protect subcontractors, materialmen and laborers on federal construction work.

The case decided was "Clifford F. MacEvoy Co. and the Aetna Casualty and Surety Co. *versus* the United States for the use and benefit of the Calvin Tomkins Co." (No. 483, October term, 1943). The specific point in question concerned payment for materials for a defense housing project near Linden, N. J. The federal government engaged the MacEvoy firm to furnish the materials and to construct the project on a cost-plus-fixed-fee basis. Pursuant to the Miller Act, MacEvoy as principal and the Aetna Casualty and Surety Co. as surety executed a $1,000,000 payment bond conditioned on the prompt payment by MacEvoy "to all persons supplying labor and material in the prosecution of the work provided for in said contract."

MacEvoy purchased from James H. Miller & Co. certain building materials for the work. Miller in turn purchased these materials from the Calvin Tomkins Co., but failed to pay Tomkins a balance of $12,033.

Subsequently Tomkins instituted court action against MacEvoy and the surety on the payment bond. The suit came to the Supreme Court from the Circuit Court of Appeals, which had rendered a decision for Tomkins.

In reversing the finding of the Circuit Court, the Supreme Court, after reviewing the discussions in Congress at the time the Miller Act was being considered, said that it had come to the conclusion that Congress did not intend that the term "subcontractor" as used in that act should cover the more remote relationship of those supplying materials to materialmen. Section 2(a) of the Miller Act, the court said, "make clear that the right to bring suit on a payment bond is limited to (1) those materialmen, laborers and subcontractors who deal directly with the contractor and (2) those materialmen, laborers and subcontractors who, lacking express or implied contractural relationship with the prime contractor have a direct contractural relationship with a subcontractor and who give the statutory notice of their claims to the prime contractor. To allow those in more remote relationships to recover on the bond would be contrary to the clear language of the proviso and the expressed will of the framers of the act. Moreover, it would lead to the absurd result of requiring notice from persons in direct contractural relationship with a subcontractor but not from the more remote claimants."

The court went on to say that "many materialmen are usually involved in large projects; they deal in turn with innumerable sub-materialmen and laborers. To impose unlimited liability under the payment bond to those sub-materialmen and laborers is to create a precarious and perilous risk on the prime contractor and his surety. To sanction such a risk requires clear language in the statute and in the bond so as to leave no alternative."

St. Louis Post-Dispatch photo

Flood waters from the Mississippi River cutting through the Chouteau Island levee to spread over 2,400 acres of farm land.

Army Engineers Fight 100-Year Mississippi Flood

V. T. Boughton
Associate Editor, Engineering News-Record

***Contents in Brief**—For the second time in two years floods of a magnitude not exceeded in 100 years attacked several hundred miles of levees that protect nearly 1,000,000 acres of rich bottom lands in the Mississippi, Missouri, and Illinois River valleys in Illinois and Missouri. Last year, most of the levee districts were flooded. This year, all but 150,000 acres in the St. Louis District of the U. S. Engineer Department were saved from inundation through the operation of an efficient floods-fighting organization set up on the basis of last year's experience.*

FIGHTING FLOODS is part of the life of any engineer who spends many years with the U. S. Engineer Department. Col. Malcolm Elliott, division engineer, Upper Mississippi Valley Division, says that he has been fighting floods since his first assignment as a hydrographer in Panama. Few of the engineers of the department, however, have been faced with the problem of fighting floods approaching unprecedented magnitude in the same rivers in two succeeding years.

That is what happened about three weeks ago in the St. Louis Engineer District of Colonel Elliott's division and in the adjoining Kansas City District on the Missouri River Division. Last May, floods in those districts closely approached the record set in 1844; this year, the records set last year were exceeded slightly or closely approached. The gage at St. Charles at the mouth of the Missouri River registered a crest of 36.4 ft. this year as against 36.6 ft. last year; the gage at the mouth of the Illinois River, which comes into the Mississippi just above the mouth of the Missouri, crested at 33.9 ft. this year as against 34.4 ft. in 1943; and at St. Louis, below the mouth of the two rivers, the gage went to 39.1 ft. this year as against 38.9 ft. last year. The 1844 flood went to 41.4 ft. on the St. Louis gage.

There are nearly 1,000,000 acres of bottom lands in the main river valleys of the St. Louis District (which does not include the lower end of the Missouri River), of which 448,500 acres are protected by levees of varying height. Last year, 216,500 acres of the protected bottoms were flooded. That figure was cut to 152,500 acres this year as a result of the strenuous fight put up by the Army Engineers and the troops assigned to them, assisted in many instances by volunteer workers from the affected region.

The purpose of this account is to tell something of how that fight was conducted in the St. Louis District. A similar fight was carried on by engineers of the Kansas City District, along the lower reaches of the Missouri, but it was not possible for the writer to cover both operations at the same time.

The record is one of which all who participated may justly be proud, including over 10,000 soldiers from the U. S. Army and from the Illinois and Missouri State Guard. The spirit in which these men tackled the job was expressed by Scott Shaver, one of the engineers in charge of the fight to save the levees of the Preston Drainage and Levee District. When asked by Colonel Elliott whether he thought the levees could be held, he replied: "I've got

d and all the goddamn bags in the ld, and she ain't goin' over."

A well organized fight

What is told here is what was rned at first hand on a trip to t the critical points along the es, made with Col. Malcolm El- , division engineer, and Col. B. Feagin, district engineer, St. is District, on Saturday and Sun- , April 29–30, when the fight nearing its climax. Such an unt, obviously, can only touch high spots; some areas, where ditions were not critical at the e or where the fight already had n lost, were not visited.

In most respects, it was unfortun- that a flood of the magnitude of year's flood should have fol- ed within less than a year upon r-record flood of 1943, especially a time when the nation was en- ed in war and when materials d equipment were not available to ke good on the lessons learned in 3. In normal times, the weak nts that were discovered last year uld have been strengthened and ny miles of substandard levee sec- s would have been brought up standard as part of the normal k of the U. S. Engineer De- tment. But in the few months that e elapsed since the 1943 flood, that could be done was to repair spring's damage. Because of restrictions, no new work could undertaken, nor was it even pos- le to carry the levees that had to replaced to the so-called "project de," the level that the army engi- rs had determined to be the eleva- required for adequate protection. act of Congress providing funds the repair work stipulated that money was to be used only for lacements.

Officers and men available

In a few respects, however, the rt space of time between floods the fact that the nation had mo- ed a vast army contributed to success of this year's fight. In first place, troops were available, was equipment to move those ps and to feed them. Also avail- were many young engineer cers in the training school at the nite City Engineer Depot across river above St. Louis commanded Col. J. R. Brownell. Those young men, many of whom had never seen a levee before, were assigned to the area engineers to help them and to make it possible for the area engineers to get a little rest.

Typical is the case of a second lieutenant named McCullough, who was assigned to assist Capt. I. A. Fietsam in the unsuccessful fight to save the Harrisonville levee and the successful fight to save levees protecting the Columbia district.

Our party picked up Captain Fietsam at his emergency office which had been set up in the surrogate's rooms of the courthouse at Waterloo, Ill. Captain Fietsam was obviously in need of a rest. When asked whether the assistant assigned to him had not arrived to give him the needed rest, he said, "Oh, yes, but I have sent him off to get some sleep as he has been up all night." But when we reached the levee there was McCullough supervising the sandbagging of a section of embankment where the wash from boats was spilling over the top.

Shaded areas on this map indicate the bottom lands protected by levees in the sections of the Mississippi, Illinois and Kaskaskia rivers included in the St. Louis District of the U. S. Engineer Department. (The Missouri River is not included in the St. Louis District). Also given are the names of the levee districts referred to in this report. In all there are over 50 districts totalling 448,500 acres.

At the St. Louis District headquarters a flood-fighting organization was set up by Col. L. B. Feagin, district engineer. Members of the staff here shown are, left to right, Capt. J. Kochanski, Lt. Col. W. F. Lawlor, W. L. Bryan, Col. L. B. Feagin, Lt. Col. J. A. Adams, and Charles R. Goddard

Without officers of this calibre and without the troops, most, if not all, the levees would have been lost.

Emergency plan was ready

Also of major importance in contributing to the success of this year's operations was the preparation of a "Flood Emergency Plan" in which a complete organization for fighting a major flood had been set up by Colonel Feagin, based on last year's experience. Key man in that plan, reporting directly to Colonel Feagin, were Lt. Col. John A. Adams, "flood executve officer," and Lt. Col. W. F. Lawlor, "assistant flood executive officer for protected areas." Once the plan was put into operation, either Colonel Adams or Colonel Lawlor was on duty at the district office at all times of the day or night to advise the engineers in charge of the seven areas into which the district was divided under the plan.

At the engineer service base for the district, Alan A. McFadden, principal engineer, served as assistant executive flood officer in charge of all floating plant and the evacuation by water of people from flooded areas. The U. S. Coast Guard cooperated in this work and in the defense of the levees. The American Red Cross took an active part in the evacuation work and assigned M. J. McNally to the district office as liaison officer.

Mr. McFadden also had charge of land transportation, a large part of which was supplied by Col. C. E. Jones of the Ordnance Motor Supply Depot.

Also set up in the district office under the "Flood Emergency Plan" were an engineer section, a flood intelligence section, and an administrative section, which kept the area officers advised as to crests to be expected, and undertook to meet their needs in men and materials. These sections were headed by Carl J. Weaver, William L. Bryan and Edward J. Harrington. Under the administrative section, Capt. J. Kochanski had charge of securing the necessary supplies, either by purchase or upon requisition from other departments.

Five area offices were set up along the Mississippi River and one each in the valley of the Illinois River and in the valley of the Kaskaskia, a tributary coming in on the Illinois side below St. Louis in which there are leveed bottom lands. These area offices were headed originally by Maj. H. J. Manger, Capts. L. Oheim, I. A. Fietsam, H. A. Miller, L. F. Trost and B. G. Goodall, Lt. M. F. Lamm, and William Auchord.

The area office for the region opposite St. Louis was divided into two sectors, one headed by Capt. E. K. Bodal and one by Capt. Donald McGlashon.

An early start

An indication of what might be expected came early in April when the Mississippi rose 10 ft. in 24 hours. As a result, setting up of the area offices was begun on April 13. The early rise subsided somewhat, but about the time the flood crests from the headwaters of both the Mississippi and Missouri had passed St. Louis, local rains of unprecedented magnitude for the month of April came, causing serious floods in the local tributaries of the main rivers and making a high flood in the main rivers inevitable. Efforts to hold the low levees and strengthen the weak points, therefore, were greatly accelerated. By Saturday, April 29, when Colonel Elliott and Colonel Feagin started on their trip of inspection, 9,200 federal and state troops and 830 prisoners of war were engaged and requests had been made for calling out 1,600 more troops.

Some areas flooded

All unleveed areas in the river bottoms already were under water, and levees protecting the Grand Tower district had been overtopped on Wednesday, flooding 2,600 acres, as had the levee protecting the Ste. Genevieve district, flooding 1,200 acres. North of Grand Tower, levees protecting the Degognia and Fountain Bluff districts were overtopped at 2 a.m. April 29, starting the flooding of 29,300 acres.

Still farther north, failure of a drainage structure had started the flooding of 13,700 acres in the Fort Chartres, Stringtown and Ivy Landing District No. 5. Levees protecting the Harrisonville and Ivy Landing District No. 2, still farther upstream, were still holding, but it was realized that, as the crest would not reach that area for about two days, the chance of holding that line of levees was slim indeed.

A second line of defense

The first stop of our inspection party was at Dupo, downstream from East St. Louis. East St. Louis itself is protected by high strong levees set well back from the main river to provide a channel for flood waters. Strong flank levees along the tributaries also protect that industrial area from backwater in those streams. But below East St. Louis the riverfront levees protecting the Wenkel, Wilson and Prairie du Pont districts are substandard, and had been breached during Friday night. Water already was flowing across the lowlands towards the Missouri Pacific railroad yards and the defense forces, profiting by last year's experience, were falling back to the embankment on which the Missouri Pacific main line passes

rough the large freight yards at upo.

On the platform of the railroad eight station, one large group of oldiers was filling bags from sand rought in on gondola cars while thers were barricading the railroad nd highway underpasses through e main-line embankment close to e railroad's roundhouse, or were king filled bags by truck to block lverts through the railroad fill.

Trouble at Harrisonville

The long levees protecting 26,700 res of land in the Harrisonville and y Landing No. 2 district are mostly low project grade, but for much their length are uncommonly wide, provision was made for a road ong the top. Taking advantage of is added width, Captain Fietsam, ing road grading equipment made ailable to him by a local contractor amed Luhr who was engaged in ressing and seeding the slopes of vee sections repaired after last year's od, had borrowed material from e land side of the road and had led it up on the river side to gain tra height. Elsewhere he was using ndbags to top out the levee at low ints, and he was optimistic as to s prospects for holding the levee. t when we visited the section rectly above the village of Harsonville, waves set up by the overuberant operator of one of the otor boats delivering sandbags to e soldiers on the levee came spilling er the crest, indicating how narw was the margin of safety.

The speed of the motor boats was omptly reduced.

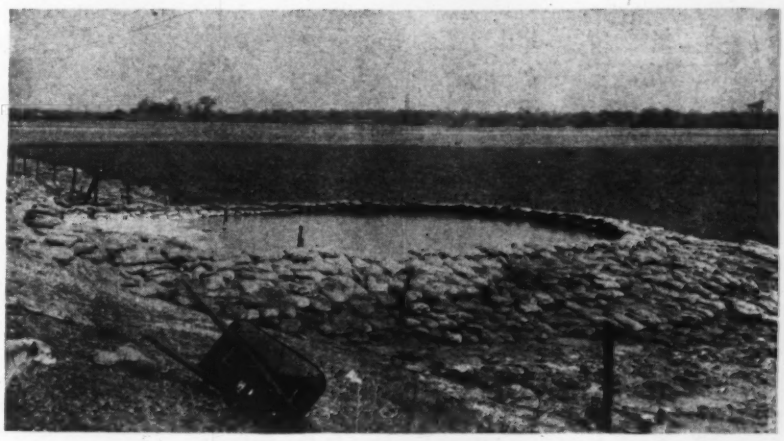
Despite the efforts of 1,000 solers, that levee was overtopped at a.m. the next morning (Sunday).

Levee lost in a sudden slump

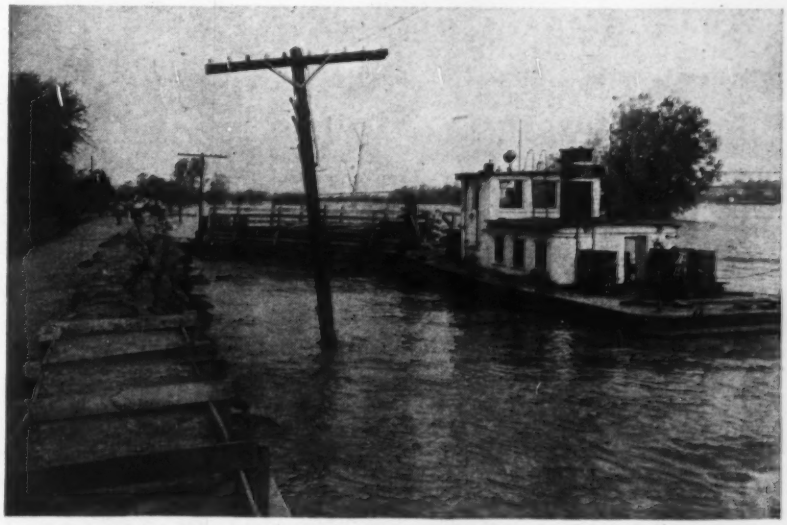
Overtopping is not the engineer's ly worry. Seepage may start untrollable sand boils on the land e of a levee, ultimately ending in destruction; or saturation of high d relatively new levees due to high ter level on the river side for sevl days may cause a sudden slump d collapse.

A sudden slump in an embankment the Preston district was what put end to the hard fight to save the gest area protected by a single line levees, the 53,400 acres in the eston, Miller Pond, Clear Creek,

The Preston levee along the Big Muddy River (left) had ample freeboard, but much of it was new and a slump due to saturation resulted in its loss. Here shown (left to right) are Col. Malcolm Elliott and Col. L. B. Feagin consulting with Wm. Douglas, associate engineer, and Lt. M. F. Lamm, area engineer.



Sand boils back of the levees are a major source of trouble during high water. They start when seepage begins to move fast enough to carry sand or silt, thus starting to enlarge a channel through the levee. Generally they can be controlled by building a ring levee as here shown to reduce the differential in head.



At Claryville the town's concrete flood wall was raised with an earth-filled box levee, and low sections of the earth embankment were topped out with sandbags.

North Alexander, and East Cape Girardeau district.

The prospects for holding that line of levees appeared bright when we visited the most critical section on Saturday afternoon, the flank levee at the north end of the Preston district along the south bank of the big Muddy River, which enters the main stream from the Illinois side between the flooded Grand Tower district and the Preston district. That levee stands high above the protected fields, some 10 or 15 ft. at many points, and on Saturday morning, a day or two before the flood crest was due, still had a fair amount of freeboard. The cut through the top of the levee made by the Illinois Central R. R. tracks at the end of the railroad bridge over the Big Muddy had been sandbagged as the railroad tracks to the north already were flooded. Between the railroad and the Mississippi, state militia were moving in to patrol the levee to watch for possible seepage and sand boils. These men brought the available troops to 3,750, hence there was good reason for the confident statement of Scott Shaver, quoted in the opening part of this account.

About 6 p.m., Capt. L. F. Trost, the area engineer, went over the levee and saw no signs of impending danger. About 10 p.m. that same night a large section, with little warning, slumped, and in a few minutes the river was pouring through the breach, making it necessary for the troops between the breach and the main river to seek refuge to the south, crossing the lowlands by roads not yet reached by the spreading floodwaters.

Delivering sand bags to top out the Chouteau Island levee on the east side of the Mississippi above St. Louis. This fight was lost, as will be seen by the picture on p. 748. Water already is among the bags in the distance.

Breaching of the McGee Creek levee was prevented by construction of a U-shaped levee around a low point left for a drainage structure. An indication of the height of the emergency embankment is given by the fact that the boat in the background is on the river.

Topping out a floodwall

Over on the Missouri side of the river at Claryville in the 23,500-acre Perry County district, the engineers had a different problem on their hands. Claryville, a little town on the river's edge opposite Chester, has a concrete floodwall along its waterfront where the ferry used to land before the Chester bridge put it out of business.

This wall, which was built by local interests, was not provided with a sheetpile cutoff. Last year it was topped out with an earth-filled box, but the town was flooded by breaches due to uncontrollable sand boils behind the wall.

In the repairs following last year's flood, the concrete wall was backed up with a wide earth fill.

Remembering last year's experience, a much more substantial box levee was built along the top of the concrete wall in the early stages of this fight, thus making it possible to concentrate on possible sand boils.

When we visited the town about dusk on Saturday, boils had begun to develop around old cisterns in one of the yards immediately behind the levee. These were being successfully controlled by ring levees, but as an added precaution a secondary defense line of sandbags was being built back of the low area in which the sand boils were developing.

Trouble at a drain outlet

Most spectacular of all the fights that we saw was the one being made in the McGee Creek district near Meredosia, Ill., a few miles below Beardstown, scene of a spectacular fight last year to save the city from flooding when the Illinois crested a little higher than in this year's flood.

The McGee Creek district levees were breached in many places last

nd had been rebuilt except at int where a new drainage struc- as to be installed by the state of . Inability to get priorities e big outlet valves needed in ructure had delayed its comple-

winter, when it became appar- at the state would not complete ork before the high-water sea- U-shaped earth embankment hrown up around the opening n the levee for the drainage ure.

en we visited the job Sunday oon, about at the crest of the there had been two serious s in the temporary levee that hreatened to let the water over p, but it had held, and thou- of sandbags were being used ttress the weak points. Water g through the sandbags in the section at the top was being d behind other sandbags some- lower down and led down gh wooden troughs to spill essly into the field some 20 ft. down the slope.

other slump occurred Sunday g, but in the end the fight was by using a hydraulic dredge to sand into the opening left in the levee.

Civilians take part

elsewhere in the fight, men of llinois State Guard, called from civilian jobs, were working on defense levee at Meredosia, g the seemingly endless flow ndbags from boats up over the f the levee and down the slope ttress the saturated bank. Food hem was being cooked in the and brought out in Coast Guard , and shelter for them would be somewhere in the town.

all, 10,800 federal troops, in- g both white and colored, and prisoners of war were used in St. Louis District. The federal s came from the Sixth or th Service Command and the ans from either the Illinois or Missouri State Guard.

r both the troops and for the g engineer officers, this flood ing provided the nearest ap- h to the real thing and gave some valuable experience. For oung officers it was an especially opportunity to demonstrate ability in leadership. That can

Occasionally the army engineers find it necessary to destroy their own handiwork. This blast was set off at the lower end of the Clear Creek district to let out the water that came in through the breach in the Preston district levee some 20 miles to the north. Because of the drop in the river along its circuitous channel, flood waters coming directly down through a levee district will rise above river level at the south end of the district. These waters can be kept from doing added damage by releasing them at a carefully selected point.

be chalked up on the asset side of the fight against high water, which otherwise was a costly operation in time, money and human energy.

As an interesting sidelight, it might be added that almost invariably the young officers drawn from the school at Granite City asked us how the levees protecting Granite City were standing the flood. Their few wordly possessions were in the barracks behind the levees thrown up in 1941 to protect the low land in that great engineer depot.

Worth the price?

A question frequently put to me is whether the results obtained from such a fight are worth the cost. Last year crop damage amounted to $21,000,000 and property damage to $10,000,000, according to the estimates of the Army Engineers. The emergency protective work cost $848,000, repairs to levees $2,269,000, rescue work $193,000 and relief and rehabilitation by the Red Cross and Salvation Army $296,000, a total of $3,606,000. This year's flood damage will be considerably less.

A continuing fight

Higher levees, channel improvements and more storage at the headwaters will reduce the volume and curtail the damage done by future floods, but no amount of such work that can be done within practical limits will entirely eliminate the risks involved in floods along rivers of the size of the Mississippi and the Missouri. Army engineers in the future will still have to fight floods if they are assigned to the U. S. Engineer Department, yet they will have an advantage over the engineers of today in that their chance of winning will be much enhanced.

Dual Grit Chamber and Measuring Flume

York Peterson
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***Contents in Brief**—Grit removal and flow measurement facilities are provided by this design, which utilizes a single channel for both purposes. Constant velocity flow is secured throughout a range of 250 to 1,000 gpm.*

A COMBINATION grit chamber and measuring flume designed for flows ranging from 250 to 1,000 gpm., and providing a constant velocity of one foot per second in the grit chamber has recently been installed at the Santa Maria (Calif.) sewage treatment plant.

The grit chamber consists of one channel of parabolic shape and a by-pass channel, the latter simply to facilitate cleaning and provide for overflow that may be caused by stoppage on the screen. A 6-in. width Parshall flume is used on the downstream end of the chamber to measure and control the flow. The head at the Parshall flume determines the head in the grit chamber, and the cross-sectional area of the channel in square feet is designed to equal the discharge in feet per second through the flume at any head. In this way the velocity of flow in the grit chamber is controlled at one foot per second.

The flow through the Parshall flume is represented by the formula $Q = 2.06\ h^{1.58}$, and the flow in the channel is the product of the cross-sectional area and the velocity, or $Q = av$.

Where Q = discharge in cubic feet per second;
a = area in square feet;
v = velocity in feet per second;
h = head in feet.

Then, when v = one foot per second, $Q = a$.

The value of Q is determined by the head above the Parshall flume, which is also common to the grit chamber, and a is a function of the head (or height) and the width of the grit chamber.

One-half of the width of the grit chamber conforms very closely with the following formula:

$W_1 = 1.586\ h^{0.63} + 0.06\ h^{0.05}$

Integrating: $1.586\ h^{0.63} + 0.06\ h^{0.05}\ dw_1 = 0.973\ h^{1.63} + 0.0$
$h^{1.05} + C$

The total area for any head in grit chamber is:

$2\ (0.973\ h^{1.63} + 0.057\ h^{1.05})$

It is to be noted that $W = 2W_1$ cause W_1 = one-half width.

Other details of the design inc a grit collecting slot, 12 in. in w and varying in depth from 7 to 12 provided in the bottom of the chamber (see Fig 2). The leng the parabolic shaped channel is 4 which provides a 45 sec. period settlement. A stilling well constru adjacent to the Parshall flume equipped with a float and a ver water level recorder for recor height of flow.

Wooden gates with metal stem handwheel fixtures are installed each end of the channel to permit version of the flow through the pass while cleaning the chamber. wooden bar screen with 2 in. slots is employed just below the stream gate for the removal of r this has been found helpful in re ing the comminutor shredding m anism employed in the plant.

Plans for the grit chamber measuring flume were commenced June, 1943, and in accordance the regulations of the War Produc Board, a minimum of steel was sp fied throughout the design; hence wooden bar screen, wooden g etc. The construction contract awarded to Oscar Reiner, local tractor, for the sum of $1,948.

When the old Imhoff tank inst tion at Santa Maria was replaced a new sewage treatment plant in 19 a grit chamber was not consid necessary since domestic sewage was delivered to the plant. (In g eral, the new equipment installed that time consisted of a comminu pre-aeration tanks for grease scum removal, mechanically clea primary sedimentation tanks closed sludge digestion tanks.)

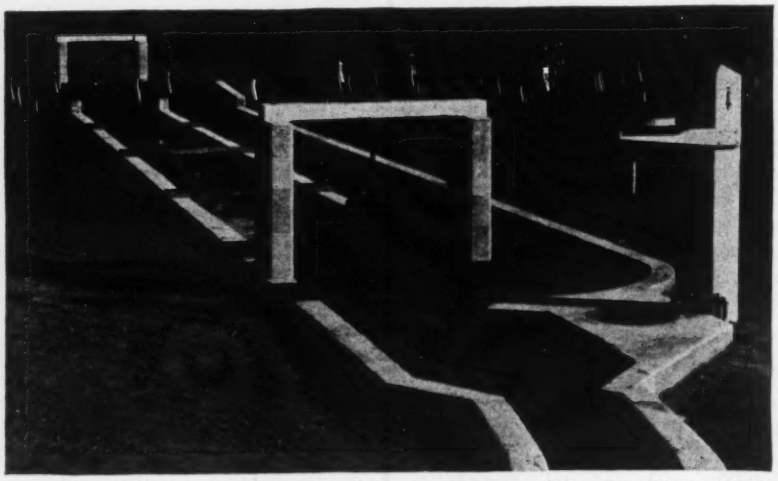
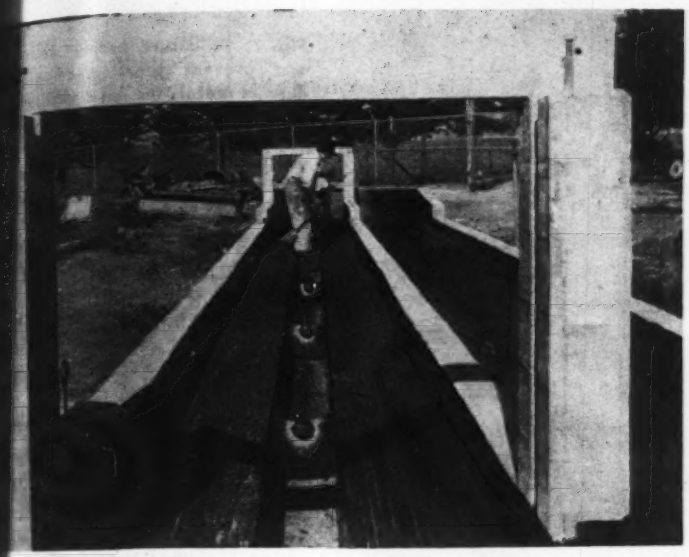


Fig. 1. Grit removal and flow measurement are combined in this single channel design. The channel at the left is simply a by-pass flume to facilitate cleaning of the grit chamber.



Interior of the parabolic chamber showing the grit collection slot. The is 12 in. wide, and varies in depth from 7 to 12 in.

tenance troubles due to the ex- wear caused by grit and also lement of grit in the pre-area- nks has long indicated the ne- of grit removal. Since the r is employed only part-time ewage treatment works, it was le to provide a method of grit l requiring little attention.

This led to the selection of the design described. Experiments with partly submerged floats indicate that the time required for traversing the 40 ft. length in the grit chamber range from 37½ to 40½ sec. Grit collection has been very satisfactory, and the design has proven to be practical from every standpoint.

ttempted Restrictions On Air Use Present New Airport Problem

success of a landowner whose ty adjoins the Allentown- hem airport in Pennsylvania in ing an injunction restraining from flying low over his land ised a new problem for the rs of airports. If such claimed to control the use of air above ner's land can be enforced in the usefulness of existing air- may be seriously impaired and a acquired for future airports ve to be enlarged, or air rights adjoining property will have to red, in order to get full use of port's runways.

stions raised by the injunction rought by the Pennsylvania on the grounds that his family estock are frightened by United s planes landing at the Allen- Bethlehem airport were discussed in the April 8 issue of *Business Week*. The following is an abstract.

These questions have brought forth a new real-estate term "avigation easement". It remains for the courts to decide just how high an avigation easement extends and how high the payment can go.

The National Association of Real Estate Boards published an article by Maj. Robert H. Fabian, Corps of Engineers, U. S. Army, in *The Appraisers Journal* in January, but there are few case histories available. However, Maj. Fabian's finding may help set a pattern.

Avigation easement is defined by the engineer as "right of unobstructed flight by aircraft at a specified altitude," and the commonest application is in approach zones at ends of army and commercial air fields. The Army Air Forces has established a standard runway approach zone which has also been adopted by many airports.

The value of an avigation easement is usually less—never more—than fee simple title of the surface property affected, and is considered equal to the difference between fair market value of unencumbered fee simple title, considered for the highest and best use, and its value after avigation easement is imposed.

Several theories have been advanced in solution of legal conflicts. One is the "ad coelum" maxim which asserts a property owner owns airspace "even up to heaven." This theory now is universally rejected since it makes every plane in flight a trespass over lands below. Another theory is the nuisance doctrine under which no flight constitutes actionable wrong to the surface owner unless it causes him harm, danger, or inconvenience; this theory, it is generally agreed, fails to provide adequate protection to property owners.

A third theory is that the surface owner owns airspace above property, subject to public right of flight at reasonable height; hence the owner can enjoin only unreasonable flights, but to determine which are unreasonable is a difficult matter. A fourth theory invokes police power to prevent erection of flight hazards; some cities have passed airport area zoning ordinances with drastic restrictions.

The most workable theory so far is one which has enabled the War Department to negotiate agreements for direct purchase of avigation easements in most cases. It holds that the surface owner owns superincumbent airspace only to the extent that he may reasonably be expected to exercise effective possession over it. This theory is consistent with an appraiser's "before and after rule" used for determining value of easements. For instance, if a real estate dealer is prevented from developing a subdivision adjoining an airport because of an avigation easement restricting the height of potential buildings, he would be paid the difference between market value of the land for subdivision purposes and its value for agricultural purposes.

The War Department does not expect a lot of lawsuits from application of this theory, but commercial air carriers may encounter many suits.

Fig. 1. To assure proper maintenance and prevent sparking on a direct-current motor, the mica must be undercut below the surface of the hard-wearing copper commutator bars. This tool undercuts the mica to 1/16 in. below the commutator surface.

Preventive Electric Motor Maintenance

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***Contents in Brief**—Helpful rules for periodic inspection of electric motors are set down and instructions are given for proper maintenance and repair of bearings, felt seals, couplings, commutators, and brushes. Two extensive trouble-shooting check lists for electric motors are also made available, one for alternating-current motors and one for direct-current units.*

A PROPERLY EXECUTED PLAN of preventive maintenance of electrical motors on construction equipment will result in a two-fold accomplishment. Not only will it save the contractor large sums of money, but it will also be a real contribution to the war effort in speeding up construction projects and in saving critical materials. The following are practical, down-to-earth suggestions for establishing and operating a good plan of preventive electric motor maintenance.

An ideal motor maintenance program, which involves competent, periodic and systematic inspection, aims at prevention of breakdowns rather than the repair of motors. On every project a thorough survey of each motor should be made and a systematic inspection and maintenance schedule established and enforced. Records must be kept consistently on the schedule selected. Several excellent record systems for this purpose having been developed are reduced to printed form.

Systematic inspection needed

It is impossible to give any hard and fast rules for frequency of inspection, but a good maintenance schedule will include a systematic inspection. Based on average conditions found on construction projects, periodic check-ups are suggested as follows:

Once a week check the oil level in the bearings and determine if the bearings are moving freely. Check the temperature of the motor bearings and primary iron with the hand, and note if the warm air coming from open motors contains unmistakable fumes emanating from overheated insulation.

Once a month check the brush holders, brushes and shunts. Also "blow out" the motor with compressed air.

Once a year check the air gap with a feeler gage, the insulation resistance with Megger type tester, the line voltage with a voltmeter, and the load with an ammeter. Clean out and repack grease in the ball and roller bearings. Check renewal parts stock in light of the past years' experience.

Every two years dismantle the motor. See that all windings are tight and replace loose wedges and binding bands before dipping in varnish and baking. Inspect commutators and commutator connections. During general overhaul periods, remove the bracket and wash out the bearing housing, using hot kerosene oil and compressed air for this purpose if available.

Faulty bearings cause most failures

Bearings probably cause more shutdowns, delay and expense in electrical motor operation than

her cause. This fact is not surpris-g, when it is remembered that they e victims of poor foundations, mis-gnment, vibration, thrust from uplings, dirt, under and over lubri-tion, and frequently the wrong bricant. All this in addition to their l job of supporting a rapidly re-lving part.

The first requirement of successful aring operation is lubrication. This tails more than just an adequate pply of lubricant; the lubricant, the aring design, and its condition, st be correct.

Safe operating temperature for arings under normal operating con-tions is considered a 40 deg. C. rise ove the surrounding room air or a mperature only comfortably warm the hand. Higher temperatures call r immediate investigation.

Maintenance of sleeve bearing

In a sleeve bearing, the oil sticks to e shaft and is dragged along by the tation of the shaft so as to form a edge-shaped film between it and the aring. This film carries the load, d prevents metal-to-metal contact. long as the film is established and aintained there is no metal-to-metal ntact in the bearing while the shaft rotating, and, therefore, no per-ptible bearing wear. Two outstand-g considerations govern the mainte-nce of sleeve bearing. They are: Use the correct oil to insure the ex-tence of the oil film once rotation has gun, and use of the correct babbitt minimize the destructive effects of etal-to-metal contact when the film lost, by accident, or during starting.

FIVE GOOD MAINTENANCE RULES

1. Keep motor off line when not needed, as this saves lubrication and unnecessary wear of brushes, commutator and bearings.

2. Do not leave field circuit excited unless motor has been especially designed for this type of duty. When field must be excited, caution maintenance men to be sure field circuit is opened before working on motor, and check temperature of shunt fields to see that it does not exceed 90 deg. C.

3. Keep motor clear of metal dust or cuttings that can be drawn into windings and pole pieces; magnetic attraction will draw metal parts into the air gap and damage windings.

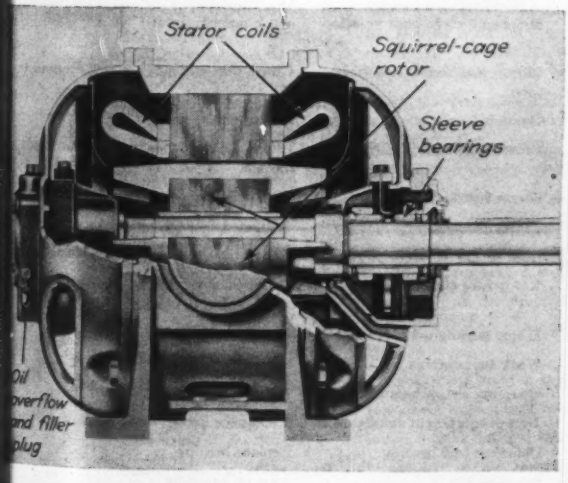
4. Before dismantling a motor be sure to measure air gaps in motor by checking bore of pole faces, which will aid to retain proper gaps in reassembly. In this latter work replace the poles and liners in their original position.

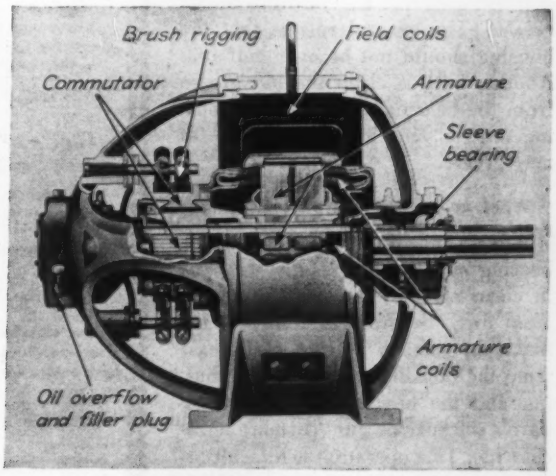
5. Note parts most frequently replaced to determine anticipated repairs, and carry store room stock of these replacements.

For proper maintenance of sleeve bearings keep the oil well filled to the proper level and the oil rings turning freely. New oil should be added only when the motor is at rest to prevent overfilling of the reservoir; oiling of bearings is often more overdone than underdone. Sleeve bearings that require frequent refilling, and thereby leak oil onto the stator windings, should be replaced with sealed sleeve-type brackets and bearings.

It is well known that oil rings generally carry far more oil than is necessary for proper lubrication of the bearing. When running, most of this oil is carried on the outside diameter of the rings by centrifugal force, which causes splashing and spray inside of the bearing housing. Air currents that pass through the housing pick up this spray and deposit it on motor windings. Sealing the bearing against the entry of air currents is therefore necessary and is accomplished in all modern designs by close tolerances, felt seals, and air by-passes to offset blower action of rotating parts.

The purpose of the felt washer in these seals, which is to keep out air and dirt, is often misunderstood. Once it becomes oil soaked, the felt has little value for preventing oil leakage. Bearing wear, which means radial movement of the shaft, spoils the effectiveness of the bearing seals, and a good maintenance rule is to replace all felt seals when replacing sleeve bearings. These felt seals should be ordered from the manufacturer of the motor. If it is necessary to make them





Cutaway section of alternating-current squirrel cage motor (left) and direct-current motor (right) showing vital parts that require periodic inspection and maintenance to prevent costly repairs.

in an emergency, use high-grade felt not less than ¼ in. thick before compression, make the inside diameter of the washer the same as the shaft or slightly less, and cut the felt true with edges at right angles to the surface of the felt.

Oil leakage is generally aggravated by high temperatures. A good rule is to keep bearings cool and use an oil that does not foam easily.

Ball bearing maintenance

Ball bearings have become increasingly important with the use of the totally inclosed, fan-cooled motor. In a ball bearing, a series of steel balls act as the separating medium, both when the motor is stationary and when it is running.

Most ball bearings used in horizontal motors are grease lubricated, although those of some vertical motors use oil. Follow the advice of the motor manufacturer in selecting a suitable grease; soda-base soap greases are usually preferred on account of their high melting point and their stability. However, they mix readily with water and tend to form an emulsion. Carelessness in allowing containers to remain open most often causes trouble from abrasive dirt.

Broken or nickel balls, which cause rapid destruction of the bearing, can usually be detected by undue heating or by unusual noise. They also can be detected by the "clicks."

If the conventional 40 deg. C rise above the surrounding air is exceeded, look for an overfilled bearing, since the first result of over-greasing is heating caused by churning of the grease. The general rule is that the housing should not be over half full. Another rule is clean the old grease from the bearing and from the housing once a year and replace it with new grease.

What to do before reassembling

After a machine is dismantled, the bearing should be carefully wrapped in clean cloth or paper to protect it from dirt. Before reassembly of the machine, remove all the old grease from the housing and clean the housing and the bearing either in Stoddard solvent or in carbon tetrachloride. This operation is difficult because particles of grit are not soluble and are not easily removed. The final residue of the cleaning medium should

TABLE 1 TROUBLE-SHOOTING CHECK LIST FOR A C MOTORS

Trouble	Cause	What To Do
Motor stalls	Wrong application	Change type or size. Consult manufa
	Motor is overloaded	Reduce load
	Low motor voltage	See that nameplate voltage is maintained
	Open circuit	Fuses are blown. Check overload re starter and pushbutton
	Incorrect control resistance of wound rotor	Check control sequence. Replace bro resistors. Repair open circuits
Motor connected but does not start	One phase open	See that no phase is open
	Motor may be overloaded	Reduce load
	Rotor defective	Look for broken bars or rings
	Poor stator coil connection	Remove end bells, locate with test lamp
Motor runs and then dies down	Power failure	Check for loose connections to line, to s and to control
Motor does not come up to speed	Not applied properly	Consult supplier for proper type
	Voltage too low at motor terminals because of line drop	Use higher voltage on transformer term or reduce load
	If wound rotor, improper control operation of secondary resistance	Correct secondary control
	Starting load too high	Check load motor is supposed to carry at s
	Low pull-in torque of synchronous motor	Change rotor starting resistance or cha rotor design
	Brushes are riding on rings	Check secondary connections. Leave no poorly connected
	Broken rotor bars	Look for cracks near the rings. A new ro may be required as repairs are usually te porary
	Open primary circuit	Locate fault with testing device and repair
Motor takes too long to accelerate	Excess loading	Reduce load
	Poor circuit	Check for high resistance
	Defective squirrel-cage rotor	Replace with new rotor
	Applied voltage too low	Get power company to increase voltage su
Wrong rotation at start	Wrong sequence of phases	Reverse connections at motor or at swi board
Motor overheats under load	Check for overload	Reduce load
	Wrong blowers or air shields. Motor may be clogged with dirt, resulting in poor ventilation	Good ventilation is manifest when a co tinuous stream of air leaves the motor. If check manufacturer
	Motor may have one phase open	Check that all leads are well connected
	Grounded coil	Locate and repair
	Unbalanced terminal voltage	Check for faulty leads connections and tra formers
	Shorted stator coil	Repair and check wattmeter reading
	Faulty connection	Indicated by high resistance
	High or low voltage	Check terminals of motor with voltmeter
	Rotor rubs stator bore	If not poor machining, replace worn bear
Motor vibrates after corrections have been made	Motor misaligned	Realign
	Weak foundations	Strengthen base
	Coupling out of balance	Balance coupling
	Driven equipment unbalanced	Rebalance driven equipment
	Defective ball bearing	Replace bearing
	Bearings not in line	Line up properly
	Balancing weights shifted	Rebalance rotor

Trouble	Cause	What To Do
vibrates	Wound rotor coils replaced ..	Rebalance rotor
rrectious	Polyphase motor running single phase	Check for open circuit
en made	Excessive end play.....	Adjust bearing or add washer
nced line	Unequal terminal volts.....	Check leads and connections
on poly-	Single phase operation.....	Check for open contacts
notors dur-	Poor rotor contacts in control wound rotor resistance	Check control devices
rmal opera-	Brushes not in proper position in wound rotor	See that brushes are properly seated and shunts in good condition
g noise	Fan rubbing air shield.....	Remove interference
	Fan striking insulation.....	Clear fan
	Loose on bedplates.....	Tighten holding bolts
tic noise	Air gap not uniform.....	Check and correct bracket fits or bearing
	Loose bearings.....	Correct or renew
	Rotor unbalance.....	Rebalance

TABLE II TROUBLE-SHOOTING CHECK LIST FOR D. C. MOTORS

Trouble	Cause	What To Do
fails to start	Circuit not complete.....	Check for open switch and broken leads
	Brushes not down on commutator	Held up by brush springs, need replacement
	Brushes stuck in holders.....	Remove and sand, clean up brush boxes
	Armature locked by frozen bearings in motor or main drive	Remove brackets and replace bearings or recondition old bearings
	Power may be off.....	Check line connections to starter with light. Check contacts in starter
starts then	Reverse polarity of generator	Check generating unit for cause of changing
nd reverses	supplying power	polarity
on	Shunt and series fields buck each other	Reconnect either shunt or series field to correct the polarity. Then connect armature leads for desired direction of rotation. Fields can be tried separately to determine direction of rotation individually and connected so both give same rotation
does not	Overload.....	Check bearing to see if in good condition
p to rated		with correct lubrication. Check driven load for excessive load or friction
	Starting resistance not all out.	Check starting to see if mechanically and electrically in correct condition
	Voltage low.....	Measure voltage with meter and check with motor name plate
	Short circuit in armature windings or between bars	For shorted armature inspect commutator for blackened bars and burned adjacent bars. Inspect windings for burned coils or wedges
	Starting heavy load with very weak field	Check full field relay and possibilities of full field setting of field rheostat
	Motor off neutral.....	Check for factory setting of brush rigging. Test motor for true neutral setting
	Motor cold.....	Increase load on motor so as to increase its temperature, or add field rheostat to set speed
runs too	Voltage above rated.....	Correct voltage or get recommended change in air gap from manufacturer
	Load too light.....	Increase load or install fixed resistance in armature circuit
	Shunt field coil shorted.....	Install new coil
	Shunt field coil reversed.....	Reconnect coil leads in reverse
	Series coil reversed.....	Reconnect coil leads in reverse
	Series field coil shorted.....	Install new or repaired coil
	Neutral setting shifted off neutral	Reset neutral by checking factory setting mark or testing for neutral

[Continued on page 108]

be removed with a light oil before adding new grease.

Check air gap on schedule

The air gap in a motor is dependent first on proper maintenance of the bearings and next on the proper alignment of the brackets or pedestals with the frame. Alternating-current motors operate with less gap than direct-current motors, and are therefore more critical. At the established schedule period, check the air gap with a feeler gauge at the pulley end, taking four readings 90 deg. apart on each motor. For motors below 10 hp., a minimum gap of 0.005 in. should be maintained, and above 10 hp., a 0.010-in. minimum.

Couplings require parallel alignment

Where coupled type motors are used, the couplings require regular inspection. Faulty alignment in a solid coupling is reflected in bearing trouble and vibration. A good rule is to make sure that all dowel pins are in correct position and to check the faces of the couplings with a feeler gauge after the bolts have been removed. To make the faces of the two half couplings parallel it is best to change the position of the motor.

Flexible couplings will operate under more severe misalignment without causing trouble; however, the two halves should be checked with a steel scale to make sure that they are in alignment. Any misalignment means increased wear on the pins, fingers, and leather discs, whichever may be used. Special type flexible couplings should be checked according to the manufacturer's instructions.

Insulation must be clean

The electrical conductors in a motor are separated from the magnetic circuit and from the mechanical assembly by materials generally grouped under the term "insulation", which is also used in commutators to separate the bars from each other and in coils to isolate individual turns. It is important that the insulation be maintained so as to function as a separator between the copper coils in the motor and the mechanical assembly.

Regardless of the type, electrical insulation materials are non-conductors only when clean and dry, thus the importance of keeping electrical equipment clean and dry cannot be overstressed. Accumulations of dust

and dirt not only contribute to insulation breakdown, but they increase the motor temperature by restricting ventilation. Dust and dirt are effectively removed with compressed air at about 50 psi. pressure, but air should not be applied against the insulation until the operator is certain that the air is free from any moisture that may have accumulated in the air line from condensation. Too great an air pressure may loosen the binding tape or injure the insulation by sandblasting with abrasive dirt, which is nearly always present. Also, it may be impossible to remove all dust and dirt with compressed air if the accumulation contains oil or grease, when a solvent will usually be required for removal of the material.

Three types of solvents in general use for this purpose are: Petroleum distillates, such as Stoddard solvent or cleaners' naphtha, carbon tetrachloride, and a mixture of the two. The distillates are the solvents having the least corrosive action on insulation varnishes, and for that reason are preferable where conditions permit. The Stoddard type solvent, with a minimum flash point of 100 deg. F., which is produced by all the major oil companies, minimizes the fire hazard, and should be used in preference to gasoline or benzene.

Before any solvent is used, the repairmen should make sure that there is good ventilation and minimum fire risk and that fire extinguishers of the carbon tetrachloride type are available. If a hose is used to spray either cleaning solution or varnish, the nozzle should always be grounded. Workmen should be guarded against breathing the fumes of carbon tetrachloride and they should be under the close observation of someone familiar with artificial respiration. Where conditions are particularly bad, such as in pits, gas masks should be worn. The clothing of the workmen should not be allowed to become saturated with the cleaning solvent.

Handle motors carefully

The commutator and its current-collecting details increase the general maintenance problems with direct-current motors. When dismantling this type of motor for periodic overhauling the following points should be observed: Support or lift the armature, which is the heart of the direct-current motor, only by its shaft. Never

TABLE II TROUBLE-SHOOTING CHECK LIST FOR D. C. MOTORS

[Continued from page 107]

Trouble	Cause	What To Do
Motor runs too fast	Part of shunt field rheostat or unnecessary resistance in field circuit	Measure voltage across field and check with name plate rating
	Motor ventilation restricted causing hot shunt field	Hot field is high in resistance. Check current for hot field, in order restore normal field current
Motor gains speed steadily and increasing load does not slow it down	Unstable speed load regulation	Inspect motor to see if off neutral. Check series field to determine shorted turns. If series field has a shunt around the series circuit it can be removed
	Reversed field coil shunt or series	Test with compass and reconnect coil
	Too strong a commutating pole or commutating pole air gap too small	Check with factory for recommended changes in coils or air gap
Motor runs slow continuously	Voltage below rated.....	Measure voltage and try to correct to name plate value
	Overload.....	Check bearings of motors and the drive to see if in first class condition. Check for excessive friction in drive
	Motor operates cold.....	Motor may run 20 percent slow due to light load. Install smaller motor, increase load or install partial covers to increase heating
	Neutral setting shifted.....	Check for factory setting of brush rigging and test for true neutral setting
	Armature has shorted coils or commutator bars	Remove armature and put in first class condition
Motor overheats or runs hot	Overloaded and draws 25 to 50 percent more current than rated	Reduce load by reducing speed or gearing in drive or loading in drive
	Voltage above rated.....	Motor runs drive above rated speed, requiring excessive horsepower. Reduce voltage to nameplate rating
	Inadequately ventilated.....	Location of motor should be changed if restricted surroundings removed. Covers used for protection should be modified or removed. (Open motors cannot be totally enclosed for continuous operation)
	Draws excessive current due to shorted coil	Repair armature coils or install new coils
	Grounds in armature.....	Locate grounds and repair or rewind with new set of coils
	Armature rubs pole faces due to off center rotor, causing friction and excessive current	Check brackets or pedestals to center rotor and determine condition of bearing wear for bearing replacement
(a) Hot armature	Core hot in one spot indicating shorted punchings and high iron loss	Sometimes full slot metal wedges have been used for balancing. These should be removed and other means of balancing be investigated
	Punchings uninsulated. Punchings turned or band groves machined in the core. Machined slots	"No load" running of motor indicates hot core and drawing high no load armature current. Replace core and rewind armature. If necessary to add band groves, grind core. Check temperature on core with thermometer; should not exceed 90 deg. C.
(b) Hot commutator	Brush tension too high	Limit pressure to 2 psi. Check brush setting and limit to density recommended by manufacturer
	Brushes off neutral.....	Reset neutral
	Brush grade too abrasive....	Get recommendation from manufacturer
	Shorted bars.....	Investigate commutator mica and undercutting and repair
	Hot core and coils transmitting heat to commutator	Check temperature of commutator with thermometer to see that temperature does not exceed ambient plus 55 deg. C. rise, total not to exceed 105 deg. C.
	Inadequate ventilation.....	Check as for hot motor

Cause	What To Do
Voltage too high	Check with meter and thermometer and correct voltage to nameplate value
Shorted turns or grounded turns	Repair or replace with new coil
Resistance of each coil not the same	Check each individual coil for equal resistance to be 10 percent. If one coil is too low, replace coil
Inadequate ventilation	Check as for hot motor
Coil not large enough to radiate its loss wattage	New coils should replace all coils if room is available in motor
Armature out of balance	Remove and statically balance or balance in dynamic balancing machine
Misalignment	Realign
Loose or eccentric pulley	Tighten pulley on shaft or correct eccentric pulley
Belt or chain whip	Adjust belt tension
Mismating of gear and pinion	Recut, realign, or replace parts
Unbalance in coupling	Rebalance coupling
Bent shaft	Replace or straighten shaft
Foundation inadequate	Stiffen mounting place members
Motor loosely mounted	Tighten holding down bolts
Motor feet uneven	Add shims under foot pads to mount each foot tight
Neutral setting not true neutral	Check and set on factory setting or test for true neutral
Commutator rough	Grind and roll edge of each bar
Commutator eccentric	Turn and grind commutator
Mica high, not undercut	Undercut mica
Commutating pole strength too great causing over compensation or strength too weak indicating under compensation	Check with manufacturer for correct change in air gap or new coils for the commutating coils
Shorted commutating pole turns	Repair coils or install new coils
Shorted armature coils on commutator bars	Repair armature by putting into first class condition
Open circuited coils	Same as above
Poor soldered connected to commutator bars	Resolder with proper alloy of tin solder
High bar or loose bar in commutator at high speeds	Inspect commutator nut or bolts and retighten and return and grind commutator face
Brush grade wrong type, brush pressure too light, current density excessive, brushes stuck in holders, or brushes shunt loose	See data below under heading "Brush wear excessive"
Brushes chatter due to dirty film on commutator	Resurface commutator face and check for change in brushes
Vibration	Eliminate cause of vibration by checking mounting and balance of rotor
Brushes too soft	Blow dust from motor and replace brushes with grade recommended by manufacturer
Commutator rough	Grind commutator face
Abrasive dust in ventilating air	Reface brushes and correct condition by protecting motor
Off neutral setting	Recheck factory neutral or test for true neutral
Bad commutation	See corrections for commutation
High, low or loose bar	Retighten commutator motor bolts and resurface commutator
Brush tension excessive	Adjust spring pressure to not exceed 2 psi.
Electrical wear due to loss of film on commutator face	Resurface brush faces and commutator face
Threading and grooving	Same as above

[Continued on page 110]

allow the weight of the armature to rest on the commutator or on the coils. Inspect the coils carefully to see that they are tight, and where necessary replace the wedges. Replace any bands that may be loose.

If the bands must be replaced, duplicate the banding originally furnished by the manufacturer as far as possible. Repairmen should not change the material in the banding wire, the diameter of the banding wire, or the width or position of the band, as increasing the band width may cause heavy currents in the bands sufficient to overheat and melt the solder.

Only experienced workmen should tighten loose commutators. If the commutator bars are tight they will give out a clear bell-like ring when tapped lightly with a small hammer. If the commutator gives out a flat sound when struck, the front Vee should be tightened.

The exposed portion of the front mica V ring is normally a catchall for oil and dirt. This section should be cleaned and protected with a layer of surgical tape and twine to prevent flashovers and a breakdown to the ground. Red synthetic enamel will give a smooth finish, resistant to oil and carbon dust.

The brush rigging must be checked carefully. Most brush holders in use today are of the box type, and the brush holder always should be replaced when the inside broached section is worn.

Brushes must fit properly

The brushes themselves must fit properly—not so tightly as to stick, and not so loosely as to shift position when running. The repair crews should make sure that the grade used is correct for the application, using the advice of the manufacturer. Also, the workmen should be sure that the fit of the brush on the commutator extends across the entire face of the brush.

The spring tension on the brushes, which should be staggered in pairs of arms to prevent grooving of the commutator, should be uniform to prevent selective action. The correct pressure will vary with the design of the machine and adjustments should follow the recommendation of the manufacturer. Brush shunts should be kept tight and free from excessive corrosion so that current will be uni-

TABLE II TROUBLE-SHOOTING CHECK LIST FOR D. C. MOTORS
[Continued from page 109]

Trouble	Cause	What To Do
Brush wear excessive	Oil or grease from atmosphere or bearings	Correct oil condition and surface brush faces and commutator
	Weak acid and moisture laden atmosphere	Protect motor by changing ventilating air, or change to enclosed motor
Motor noisy	Brush singing	Check brush angle and commutator coating, resurface commutator
	Brush chatter	Resurface commutator and brush face
	Motor loosly mounted	Tighten foundation bolts
	Foundation hollow and acts as sounding board	Coat underside with sound proofing material
	Strained frame	Shim motor feet for equal mounting
	Armature punchings loose	Replace core on armature
	Armature rubs pole faces	Recenter by replacing bearings or relocating brackets or pedestals
	Magnetic hum	Refer to manufacturer
	Belt slap or pounding	Check condition of belt and change belt tension
	Excessive current load	May not cause over heating but check chart for correction of shorted or ground and coils
	Mechanical vibration	Check chart for causes of vibration
	Noisy bearings	Check alignment, loading of bearings, lubrication and get recommendation of manufacturer

formly distributed to the brushes. Under bad conditions of corrosive atmosphere the shunts can be protected by being dipped in melted paraffin or synthetic red enamel, or by being covered with woven cotton tubing.

Resurfacing of the commutator should be done in a lathe, or with a grinding rig. As it is impossible to obtain a true surface with a hand stone, it should be used only as an emergency. Practically all up-to-date direct-current machines have undercut mica in the commutators. This undercutting should be $\frac{1}{16}$ in. deep.

To summarize, proper maintenance, as outlined in the foregoing, is important even in normal times, but in these times when our war effort is demanding the most of our critical materials, manufacuring facilities and manpower, the importance of an adequate maintenance program cannot be overstressed. Such a program will do much toward maintaining peak operating efficiency of electrical motors and making existing critical materials last for the duration.

Mexico Expands Electric Power and Cement Mill Facilities

In order to meet the growing power needs of its rapidly expanding industries, Mexico will invest about $8,000,000 this year in electrification works as part of a long-range $62,000,000 power expansion program.

Electrification projects for 1944, as announced by President Manuel Avila Camacho, will include construction of power plants in Oaxaca, Tlaxcala, Puebla, Coahuila and Yucatan.

The industrial development of Mexico has long been retarded because the country has no cheap coal resources, therefore the current electric power development program has been undertaken in an effort to overcome this handicap. The best statistics available indicate that only about five percent of the country's potential electric power resources have so far been developed.

There are five large electric power systems and ten other power plants of more than 3,000-kw. capacity now in operation. The largest of these systems is the Compania Mexicana de Luz y Fuerza Metriz, S.A., with a capacity in excess of 235,0 Other large electric power sys clude the following: Compani cula y de Fuerza Electrica Conchos; Compania de Tranv y Fuerza de Puebla, S.A.; Compania Electrica de Chapala and Compania Hidroelectrica juateuse.

The Ixtapantongo hyd project, being developed by th eral Electric Commission Tilostac River, 100 miles Mexico City, will supply power to a region inhabit about 3,000,000 persons. Sur now being made to determine visability of constructing a lar tric power plant at E. Palmito tion dam to provide current large section of Chihuahua.

Mexico's 10-yr. electric po pansion program has been pr by the Federal Electric Comm It is interesting to note that the production index rose from 1935 to 160 in 1943 (monthly of 1929 equals 100).

Roads and cement plants

The electric power expansi gram is only one of many ne struction developments being taken in Mexico. The governme set up a $16,000,000 fund fo construction, reconditioning a servation for 1944, the amount for this purpose in the try's history.

Likewise, Mexico is expand domestic capacity for the pro of cement to meet the increased of its road-construction progra other building activities.

According to an economic published by the National Ba Mexico cement production fro domestic plants increased in 744,000 tons from 584,000 in This included production from plant opened last year near the Guadalajara.

This year, the bank report plants are scheduled to begin tions at Lagunas, Mazatlan, pantla and Monterrey. It is plan put in operation the old plant in terrey, as well as new units in coac, Cuernavaca, and possibly two in Orizoba. The total capac aggregate 1,494,050 tons of which will imply a 300 per c crease in capacity over and abo of 1942.

From Field and Office

KING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

n Curve Problems Solved alculating Machine

ffice practice highway engineers ten confronted with the problem scribing a return curve that gent to a given curve and must through a given point on a tangent. As this involves three wn quantities, many engineers tricate handbook formulas in- considerable longhand calcu- However, this problem may be by carrying two problems in a ating machine simultaneously, uantities are large, by operating achines simultaneously. Either d results in a rapid and direct n.

r cases or conditions are found t in application of the formula, volving reverse curves and two ing compound curves. However, es can be determined by inspec- y the following formula, which -explanatory when referred to companying diagram. Careful algebraic signs is essential.

a typical problem, assume that ls radius of known curve; Point ls point on given tangent; and 2 is center of known curve. The o obtain the solution are as fol-

$2C$ equal to closing line be- Points 1 and 2 and ϕ equal to ion angle between Line 1-2 dial at Point 1. Then multiply $\pm\frac{R}{2}\Big)$ and enter C in left dial $\frac{2}{C}\left(\pm\frac{R}{2}\right)$ in right dial. Next ϕ in left side and $\frac{R}{2C}$ in right f keyboard. Finally, multiply esultants in dials are equal, gives value of X. The multiplier value of r.

n example, solve Case 1 in the panying sketch. To do this find of X and r, assume that R = $C = 100.0$ and $\phi = 60$ deg.

$83 = \frac{R}{2C}$; 83.0 = $\frac{R}{2}$ and 68.89 = $\frac{R}{2C}\left(\frac{R}{2}\right)$.

chart in the next column shows

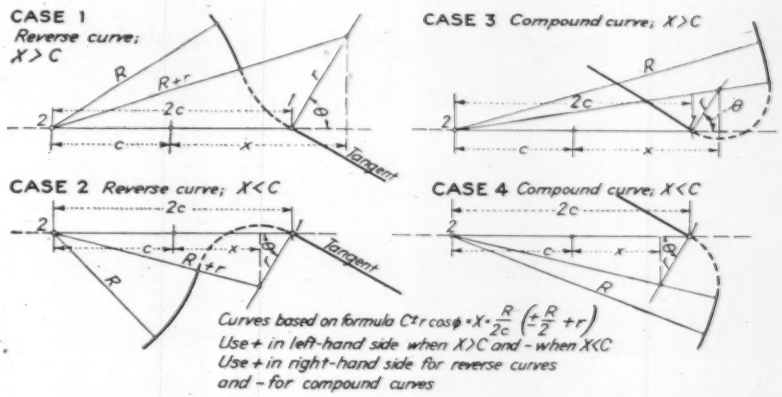
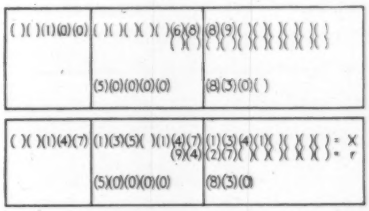


Fig. 1. Typical return curve problems that may be solve quickly on a calculator.



the operation on the machine.

In single machine solution where one operation is negative and the other positive, the left hand problem must be inverted. This resultant will appear inverted and the other upright. —Dan K. Conger, Santa Cruz, Calif.

Field and Office Comment

Accurate Cube Root

Sir: Four times during the last year (Aug. 26, Nov. 4, Dec. 16 and Dec. 30) letters have been published in *Engineering News-Record* expounding "simple" methods of extracting square and cube root. By a curious coincidence, all of these letters used variations of the same method, and all neglected to mention the simplest and quickest method.

The method described in *ENR*, Dec. 30, p. 939, can be analyzed more easily than the one published Nov. 4. If y is the number whose cube root is to be extracted, and

$$y = x^3,$$

then it is assumed that $x = x_1 + dx$, where x_1 is the cube root of a number smaller than y, which can be found in a "standard table". Then, $x^3 = x_1^3 + 3x_1^2dx + 3x_1dx^2 + dx^3$. Disregarding all terms containing dx^3 and dx^2, this becomes:

$$x^3 = x_1^3 + 3x_1^2\,dx \text{ or } dx = \frac{x^3 - x_1^3}{3\,x_1^2}$$

The claim is made that dx is so small that this assumption is correct, and that dx can be computed with sufficient accuracy on a slide rule.

An examination of a table of cube roots shows that the greatest value of dx will occur for $y = 100{,}999.9$, when 7-place results are required with tables of cube roots of 3-place numbers. Computed long-hand, dx is found to be 0.15047 and x_1, the cube root of 100,000, computed by logarithms, is 46.41590. The required cube root, computed in this way, is 46.56637; while when computed with 10-place logarithms, the result is 46.57008. In other words, the method only gives the first four significant figures accurately. In this case, dx has five significant figures, and the assumption that dx^2 and dx^3 can be ignored is not true. Neither can the equation be solved accurately with a slide rule.

The smallest value of dx will occur when the cube root of 9,990,001 is required. In this case, $x_1^3 = 9{,}990{,}000$, $x_1 = 215.3716$ and $dx = .0000071$ and will be neglected when 7-place accuracy is desired. Over part of the possible range of such problems, a slide rule would give accurate results,

but over other large parts of the range, the results would not be accurate, even if the computations were made with the greatest care. It is very difficult to define the limits within which the equation is inaccurate, those within which the results are accurate if computations are carefully made, and those within which a slide rule gives satisfactory results.

In the example given, the cube root of 71,215.68, dx is 0.05013 when computed to the point required for 7-place accuracy. The result is then 41.45013 and the error is 7 in the last place.

Anyone who knows how to use logarithms will know that the square root, cube root, fourth root, or 67.93th root can be computed easily and quickly with logarithms, and the results will be accurate within one or two units in the last significant figure, over any part of the possible range. Satisfactory log-tables are available for 4, 5, 6, 7, and 10 significant figures. A slide rule will give cube roots accurately to three significant figures. The following table gives an idea of the time required to compute the cube root of 71,215.68 with a slide rule, with different log-tables, and by the two different "approximate" methods, when the computations are carried out long-hand to seven places.

CUBE ROOT OF 71,215.68
by different methods

Method	Result	Time Required
5″ slide rule	41.5	15 sec.
4-place logs	41.45	50 sec.
5-place logs	41.451	1½ to 2 min.
7-place logs	41.45008	2½ min.
10-place logs	41.45006432	6 to 8 min.
Approximate method (*ENR* Nov. 4, 1943)		
First approximation	41.449	6 min.
Second approximation	41.44985	14 min.
Method of Dec. 30, 1943	41.45013	4½ min.

None of the existing tables of cube roots are arranged for rapid and accurate interpolation. I have experimented with the construction of such tables, and sample pages give the following average times for computing cube root:

4-places	20 seconds
5-places	30 seconds
6-places	1 min. 20 sec.

These times are about one third those required with logarithms, one ninth of the time required for approximate methods. With such tables the greatest error should not be more than one in the last significant figure. The approximate methods are subject to quite large errors.

The above was written before reading the letter by C. W. Raynor, titled "Work to Obtain Roots Made Simplified," in *ENR*, Jan. 13, 1944, p. 56. The method he used is given on p. 412 of the College Algebra by Edward A. Bowser (Fourth Edition, published in 1891), who says, "A root may *often* be extracted by means of the Binominal Theorem." In practice it is better to use a method that always works. To test Mr. Raynor's method just try it on the example that has been tried several times already.

CUBE ROOT OF 71,215.68

$$71{,}215.68^{1/3} = (41.4^3 + 257.736)^{1/3}$$

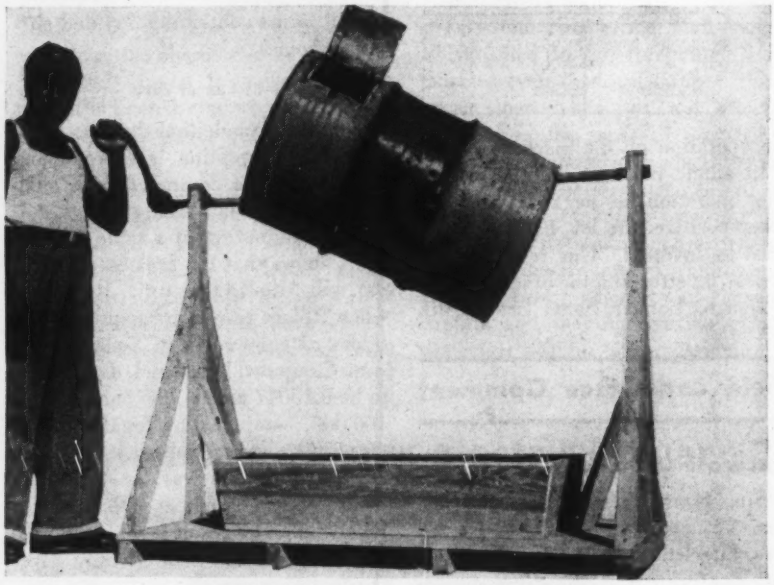
$$= 41.4\left(1 + \tfrac{1}{3}\cdot\frac{257.736}{41.4^3}\right)$$

$$= 41.412 \text{ (instead of } 41.4506\text{)}$$

	71,215.68
41.4^3 =	70,957.944
Diff. =	257.736

After this example, it is hardly necessary to try the same method on the cube root of 100,999.9.

CHARLES HERR
New York, N



MIXING DEVICE FOR DRY CHEMICALS

Common practice in anti-mosquito work is to dust the surface of water breeding places with a mixture of Paris green (an arsenical compound) and a dry diluent such as hydrated lime or road dust. To assure thorough mixing of these dry components, Ralph Howard, chief of the American sanitary mission working in Haiti, devised the mixer pictured above.

It consists of nothing more than an old oil drum, the bottom and head of which are pierced with holes to accommodate a shaft made from ¾-in. water pipe. A square hole (about 6x6 in.) cut in the side of the drum and fitted with a metal cover provides for the entry and removal of the chemicals.

Mounted on a wood frame and turned by hand, the drum revolves eccentrically and thus assures complete and intimate mixing of the materials in quick order and without creating a dust nuisance.

CAMERA MEMORANDUM

Construction of numerous ma culverts on the Inter-American h way in Nicaragua for a short t proved difficult because the ma dried too rapidly in the hot sun checked badly. At the suggestion Maj. W. A. Ford, area engineer for U. S. Engineers, a roof of poles cov by a thick layer of branches was over one culvert site. The trouble too rapid curing was overcome and scheme was used for other struct

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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

AIRPORT, DANVILLE, VA.

OWNER: Civil Aeronautics Administration, First Region, LaGuardia Field, N. Y.

PROJECT: Clearing, grading, draining and paving the Danville, Virginia Municipal Airport, consisting of the following: 1,600,000 cu.yd. of excavation necessary for grading three runways and taxiways; 45,000 feet of pipe for field taxiway, runway and outfall drainage; paving three runways, 5,000 ft. by 150 ft. and taxiway 9,700 ft. by 50 ft., together with necessary apron; and other appurtenant work within limits of airport property if ordered. Alternates were allowed for concrete paving (Schedule II) or for bituminous paving (Schedule III). Also combined site preparation (Schedule I) and concrete paving (Schedule IV) and for combined site preparation and bituminous paving (Schedule V). Contracts were awarded on basis of Schedules I and III, separately. Unit price tabulations shown below are on this basis.

CONDITIONS: Contractors to furnish all materials and complete work on Schedule I in 120 calendar days, and on Schedule III in 110 calendar days. Rail and highway transportation facilities available. Wage rates specified as minimums are: skilled labor, $1.00 to $1.50 per hour; semi-skilled, 60 to 75c.; and common, 50c.

BIDS: Fifteen bids were received on Schedule I (Preparation of site) February 15, 1944. They ranged from the contract low of $508,463 to $1,125,766. Engineer's estimate was $696,092. On Schedule III (Bituminous paving) seven bids were opened on the same date, ranging from the contract low of $702,660 to $2,737,358. Engineer's estimate was $962,972.

Schedule I—Preparation of Site

LIST OF BIDDERS:

1. Mecklenburg Constr. Co., Durham, N. C. (contract) $508,463
2. The Grandview Co., Mt. Vernon, N. Y. 549,009
3. Chandler Bros., Inc., Virgilina, Va. 581,633
4. McVaugh-Haynes Co., Peoria, Ill. 618,189
5. Kiker & Yount, Reidsville, N. C. 638,682
6. Ralph Myers Constr. Co., Salem, Ind. 675,153
7. Reiss & Weinsier, Inc., Brooklyn, N. Y. 741,691
8. Albert Bros., Salem, Va., and Pendelton Constr. Corp., Wytheville, Va. 770,127
9. M. DeMatteo Constr. Co., Milton, Mass. 789,233
10. Peter Mitchell, Inc., Paul Bacco & Son, Inc., Greenwich, Conn. 791,973
11. Bero Engr. & Constr. Corp., Buffalo, N. Y. 799,994
12. John B. Schultz Contracting Co., Buffalo, N. Y. 829,834
13. S. J. Groves & Sons, Inc., Ridgefield, N. J. 848,304
14. John Arborio, Inc., Poughkeepsie, N. Y. 1,084,459
15. Baltimore Contractors, Baltimore, Md. 1,125,766

Item	Quan	Unit Prices (1)	(2)	(3)
1. Clearing and grubbing	Lump Sum	$8,000.00	$10,500.00	$11,500.00
2. Clear and grub (if ordered)	10 ac.	125.00	250.00	180.00
3. Clearing (if ordered)	70 ac.	125.00	125.00	75.00
4. Unclassified excavation	1,600,000 c. y.	.20	.235	.24
5. 8-in. drain pipe, open joint	5,400 l. f.	.60	.45	.70
6. 10-in. drain pipe, open joint	6,150 l. f.	.80	.65	.85
7. 12-in. drain pipe, open joint	7,100 l. f.	.90	.75	1.05
8. 15-in. drain pipe, open joint	10,700 l. f.	1.10	1.25	1.25
9. 18-in. drain pipe, open joint	3,570 l. f.	1.50	1.65	1.80
10. 21-in. drain pipe, open joint	1,750 l. f.	2.10	2.15	2.25
11. 24-in. drain pipe, open joint	1,600 l. f.	2.60	2.95	2.80
12. Unclassified exav. for drain	17,000 c. y.	.30	.40	.55
13. Compacting earth backfill	4,000 c. y.	.30	.35	.90
14. Porous backfill	10,500 c. y.	4.00	3.80	4.60
15. 6-in. drain pipe, sealed joint	300 l. f.	.70	.50	.60
16. 8-in. drain pipe, sealed joint	1,830 l. f.	.95	.65	.75
17. 10-in. drain pipe, sealed joint	450 l. f.	1.05	1.00	1.00
18. 12-in. drain pipe, sealed joint	1,020 l. f.	1.25	1.20	1.20
19. 15-in. drain pipe, sealed joint	2,090 .f.	1.50	1.80	
20. 18-in. drain pipe, sealed joint	1,020 l. f.	2.00	2.50	
21. 21-in. drain pipe, sealed joint	1,110 l. f.	2.50	3.25	
22. 24-in. drain pipe, sealed joint	740 l. f.	3.30	4.50	
23. 12-in. Transite pipe spillway	600 l. f.	2.00	1.80	
24. Circular manholes, frames and grates	75 ea.	235.00	130.00	
25. Rectangular manholes, fr. and grates	48 ea.	245.00	130.00	
26. Remove exist. drainage struct.	4 ea.	50.00	70.00	
27. Change elevation of manholes	5 ea.	100.00	25.00	
28. Catch basins	136 ea.	110.00	65.00	
29. Septic tank	1 ea.	450.00	400.00	
30. Concrete for headwalls, etc	200 c. y.	50.00	32.00	
31. Grouted stone riprap	300 s. y.	3.50	2.00	
32. Sod for berm protection	2,400 s. y.	.30	.45	
33. 3-in. fiber underground ducts	9,000 l. f.	.40	.40	
34. 8-bank, 3-in. undergr. duct	100 l. f.	3.00	2.00	
35. Conc. for encasement (1:2:4)	200 c. y.	20.00	18.00	
36. Electrical manholes	2 ea.	600.00	600.00	
37. Remove exist. electr. equipment	Lump Sum	1,000.00	4,000.00	

Schedule III—Paving

LIST OF BIDDERS:

1. F. D. Cline, Greensboro, N. C. (contract) $70
2. Allegheny Asphalt & Paving Co., Pittsburgh, Pa. 96
3. Johnson, Drake & Piper, Inc., and Callanan Road Improvement Co., New York, N. Y. 97
4. Baltimore Contractors, Baltimore, Md. 1,09
5. Del Balso Constr. Corp., New York, N. Y. 1,12
6. M. DeMatteo Constr. Co., Milton, Mass. 1,31
7. Murphy Construction Co., Morgantown, W. Va. 2,73

Item	Quan.	Unit Prices (1)	(2)
1. Unclassified excavation	1,000 c. y.	$0.75	$1.00
2. 5-in. sub-base mat'l. (Cl. III)	3,500 s. y.	.05	.40
3. 8-in. sub-base material (Cl. I)	173,600 s. y.	.15	.55
4. 9-in. sub-base material (Cl. I)	124,000 s. y.	.16	.60
5. 3-in. sub-base mat'l. (Cl. 1 or II)	124,000 s. y.	.04	.27
6. 9-in. concrete parking area	3,500 s. y.	3.00	4.25
7. Emulsified asph., 3-in. base crse	669,600 gal.	.10	.11
8. Course aggregate, 3-in. base crse	33,480 ton	2.86	4.35
9. Choke aggregate, 3-in. base crse	4,200 ton	3.00	4.35
10. Key stone, 3-in. base crse	5,250 ton	3.00	4.35
11. 6-in. dry-bound macadam	49,600 c. y.	6.20	6.30
12. Aggregate, 1½-in. surf. crse	20,320 ton	4.25	5.00
13. Bitum. material, 1½-in. surf. crse	1,380 ton	18.00	24.00
14. Aggregate, surf. crse	3,330 ton	4.25	5.00
15. Bitum. material, surf. crse	200 ton	18.00	24.00
16. Bitum. mat'l., seal coat	60,600 gal.	.10	.12
17. Cover aggregate, seal coat	1,700 ton	4.00	4.00

TUNNELS, DESCHUTES PROJECT, OREGON

OWNER: Bureau of Reclamation, Deschutes Project, Oregon.

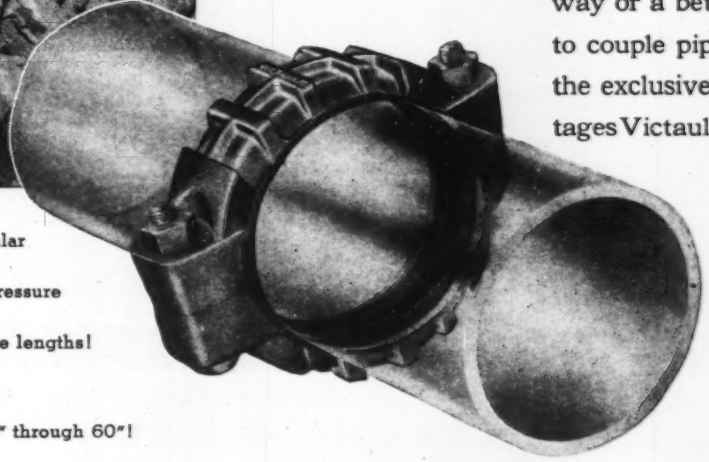
PROJECT: Construction of Tunnels No. 1 and 2, North Main Canal, two circular, concrete-lined tunnels, each an inside diameter of 11-ft. 8-in., and construction of the and outlet transitions at the portals.

CONDITIONS: The government will furnish cement, and coarse aggregate, reinforcing bars, timber for perma tunnel supports, and sewer pipe for drains. All work completed within 330 calendar days from date of noti proceed. Wage rates specified are: carpenters, $1.35 hour; concrete finishers, $1.35; laborers, unskilled, 8 muckers, tunnel, 95c.; powdermen, $1.17½; steel and dressers, $1.12½.

BIDS: Eight bids were received on Schedule 1 on Ja

One good reason why the London "Blitz" Failed...

For just plain "guts" and ability to take it... you couldn't beat the English people. Nor could you beat the method they had for keeping London's life-lines in service. As fast as Hitler could blast their water, gas and sewer lines ... the English would repair 'em and hook them back together again with Victaulic Couplings. Nobody has ever yet discovered a faster way or a better way to couple pipe. Note the exclusive advantages Victaulic offers.



1. Fast Self-Aligning permits angular deflection!
2. Leak-tight, self-sealing under pressure or vacuum!
3. Positive mechanical lock of pipe lengths!
4. Every joint is a pipe union!
5. Every joint an expansion joint!
6. Available for all pipe sizes 3/4" through 60"!

ECIAL VICTAULIC ADVANTAGES FOR INDUSTRIAL USERS!

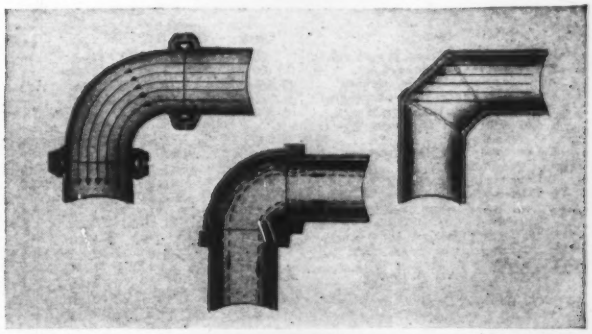
n be installed faster and with less labor than ther method!

wer installation costs... unskilled labor can do b.

expensive equipment needed ... one small h is the only tool required.

bstantial savings in space and weight.

mporary lines can be salvaged 100 per cent. enance is nil!



MORE EFFICIENT FLOW WITH VICTAULIC FULL-FLOW FITTINGS!
Left-hand illustration shows Victaulic's smooth, unrestricted flow. Compare it with the turbulence and restrictions of screwed and mitre-weld fittings also illustrated. Victaulic Full-Flow means increased delivery, lower pumping costs. There's a Victaulic Fitting to meet every piping need.

BUY MORE WAR BONDS!

VICTAULIC

Reg. U. S. Pat. Off.

LIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

Copyright 1944 by Victaulic Co. of America

NEW VICTAULIC CATALOG MANUAL

...a must for every firm that uses pipe. Contains all you need know about Victaulic Couplings and Full-Flow Fittings. Write to nearest address for your copy today on your firm's letterhead. Victaulic Company of America, 30 Rockefeller Plaza, New York 20, N. Y.; Victaulic Inc., 727 West 7th St., Los Angeles 14, Calif.; Victaulic Co. of Canada, Ltd., 200 Bay Street, Toronto

31, 1944, ranging from the low of $227,745 to $340,440. On Schedule II the eight bids ranged from $223,945 to $334,630. and on the combination of the two schedules, they ranged from $451,690 to $675,070.

Schedule I—Tunnel No. 1

LIST OF BIDDERS:

1. Wixson & Crowe, Redding, Calif. (low bidder) $227,745
2. Morrison-Knudsen Co., Inc., Boise, Idaho 274,152
3. J. A. Terteling & Sons, Boise, Idaho 283,093
4. Rumsey & Co., Seattle, Wash. 288,125
5. Kern & Kibbe, Portland, Ore. 316,475
6. Ralph A. Bell, San Marino, Calif. 325,174
7. L. E. Dixon Co., Los Angeles, Calif. 336,060
8. T. E. Connelly, Inc., San Francisco, Calif. 340,440

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation, common, in open cut	50 c. y.	$0.50	$1.10	$2.00
2. Excavation, rock, in open cut	100 c. y.	1.00	3.50	4.00
3. Excavation, all classes, in tunnel	18,250 c. y.	9.00	10.60	11.25
4. Erect permanent timbering in tunnel	60 Mbm.	50.00	100.00	100.00
5. Construct 6-in. tunnel drain	1,000 l. f.	1.00	1.00	1.00
6. Lay 6-in. sewer pipe, cemented joints	200 l. f.	.75	.75	5.00
7. Conc. in portal structures and transitions	190 c. y.	8.00	50.00	30.00
8. Concrete in tunnel lining	4,020 c. y.	14.00	15.10	16.50
9. Placing reinforcement bars	19,000 lb.	.04	.07	.05
10. Drill grout holes over 10-ft. deep	200 l. f.	.70	.60	1.00
11. Place grout pipe and connections	100 lb.	.20	1.10	.50
12. Pressure grouting	400 c. f.	1.00	2.50	2.00
13. Backfill	250 c. y.	.30	1.10	.50
14. Puddling or tamping backfill	50 c. y.	.50	2.20	2.50

Schedule II—Tunnel No. 2

LIST OF BIDDERS:

1. Wixson & Crowe, Redding, Calif. (low bidder) $223,945
2. Morrison-Knudsen Co., Inc., Boise, Idaho 269,345
3. Rumsey & Co., Seattle, Wash. 282,925
4. J. A. Terteling & Sons, Boise, Idaho 283,213
5. Kern & Kibbe, Portland, Ore. 311,100
6. Ralph A. Bell, San Marino, Calif. 319,680
7. L. E. Dixon Co., Los Angeles, Calif. 330,320
8. T. E. Connelly, Inc., San Francisco, Calif. 334,630

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation, common, in open cut	50 c. y.	$0.50	$1.10	$6.00
2. Excavation, rock, in open cut	100 c. y.	1.00	3.50	6.00
3. Excavation, all classes, in tunnel	17,950 c. y.	9.00	10.60	10.50
4. Erect permanent timbering, tunnel	60 Mbm.	50.00	100.00	50.00
5. Construct 6-in. tunnel drain	1,000 l. f.	1.00	1.00	1.50
6. Lay 6-in. sewer pipe with cemented joints	200 l. f.	.75	.75	1.00
7. Concrete in portal structures and transitions	180 c. y.	8.00	50.00	40.00
8. Concrete in tunnel lining	3,950 c. y.	14.00	15.10	20.00
9. Place reinforcement bars	18,000 lb.	.04	.07	.05
10. Drill grout holes more than 10-ft. deep	200 l. f.	.70	.60	3.00
11. Place grout pipe and connections	100 lb.	.20	1.10	.50
12. Pressure grouting	400 c. f.	1.00	2.50	1.00
13. Backfill	250 c. y.	.30	1.10	2.00
14. Puddling or tamping backfill	50 c. y.	.50	2.20	4.00

AIRPORT, MERCER COUNTY NEW JERSEY

OWNER: Civil Aeronautics Administration, First Region, LaGuardia Field, N. Y.

PROJECT: Clearing, grading, draining and paving the Mercer County, N. J., Airport, consisting of the following: 250,000 c.y. of excavation necessary for grading one runway and taxiway; 8,500 l.f. of pipe for field, taxiway, runway and outfall drainage; paving one runway 3,000 ft. by 150-ft. and taxiway 1,100-ft. by 50-ft.; and other necessary work within airport limits.

CONDITIONS: Contractor will be required to furnish all necessary materials and equipment required for performa of contract except manhole frames, covers and steps, 3,440-ft. of duct. Contract time allowed is 45 days for schedule; seventy days if Schedules I and II are combi and awarded to one bidder. Rail and highway transport facilities available. Wage rates stipulated are: skilled l $1.62½ to $2.00 per hour; semi-skilled, 90c to $1.3 and common, 90c.

BIDS: Eleven bids were received March 30, 1944 on Sc ule I, ranging from the low of $214,185 to $416,831. E neers estimate, $283,138. Three bids were opened on Sc ule II the same day, ranging from $129,549 to $161 Engineers estimate, $113,490. Six bids were received Schedule III (combination of Schedules I and II) ran from the low of $387,460 to $1,010,174. Engineers esti $396,628.

Schedule I—Preparation of Site

LIST OF BIDDERS:

1. Peter Mitchell, Inc., Greenwich Conn., and Paul Bacco & Son, Inc., Stamford, Conn. (low bidder) $2
2. Circle Construction Co., White Plains, N. Y. .....
3. George M. Brewster & Son, Inc., Bogota, N. J. .....
4. Bedford Hills Constr. Corp., E. Hartford, Conn. .....
5. White Oak Excavators, Inc., Plainville, Conn. .....
6. S. J. Groves & Sons Co., Ridgefield, N. J. .....
7. A. D. Angelo & Sons, Inc., New York, N. Y. .....
8. Delma Engineering Corp., Bronx, N. Y. .....
9. Robert W. Cleveland & Co., East Orange, N. J. .....
10. The Grandview Co., Mt. Vernon, N. Y. .....
11. Lenox Construction Corp., Bronx, N. Y. .....

Item	Quan.	Unit Prices (1)	(2)
1. Clearing and grubbing	Lump Sum	$4,500.00	$1,000.00
2. Grubbing	5 ac.	100.00	200.00
3. Clearing	15 ac.	150.00	75.00
4. Unclassified excavation	250,000 c. y.	.62	.74
5. 8-in. cradle invert pipe	4,000 l. f.	1.00	.72
6. 10-in. cradle invert pipe	660 l. f.	1.25	.84
7. 12-in. cradle invert pipe	800 l. f.	1.50	1.14
8. Unclassified excavation, drainage	2,400 c. y.	6.00	3.00
9. Compacting earth backfill	600 c. y.	1.00	1.00
10. Porous backfill	1,800 c. y.	6.00	4.50
11. 8-in. pipe, field drain	340 l. f.	1.00	.72
12. 10-in. pipe, field drain	340 l. f.	1.25	.89
13. 12-in. pipe, field drain, if needed	1,800 l. f.	1.25	1.14
14. 18-in. pipe, field drain	520 l. f.	2.50	2.21
15. Remove, relay exist. 12-in. pipe	1,800 l. f.	1.00	1.75
16. Manholes, set fr. and covers, steps	14 ea.	125.00	123.00
17. Cast iron frames and grates	10 ea.	200.00	150.00
18. Change elevation of manholes	20 ea.	40.00	40.00
19. Catchbasins	12 ea.	150.00	115.00
20. Concrete for headwalls, etc	10 c. y.	40.00	28.00
21. 8-in. grouted riprap	10 s. y.	5.00	25.00
22. 3-in. fiber underground ducts	2,900 l. f.	1.00	.82
23. Three-way 3-in. duct	180 l. f.	5.00	1.26
24. 1:2:4 conc. for encasement	75 c. y.	25.00	20.00
25. Misc. electrical work, remove exist. cable	1,000 l. f.	1.00	.20
26. Remove, relocate existing lights	2 ea.	50.00	72.00
27. Change elevation of contact lights	14 ea.	30.00	68.00

Schedule II—Airport Paving

LIST OF BIDDERS:

1. Union Paving Co., Philadelphia, Pa. (low bidder) $1
2. Robert W. Cleveland & Co., East Orange, N. J. .....
3. Standard Bitulithic Co., New York, N. Y. .....

Item	Quan.	Unit Prices (1)	(2)
1. Unclassified excavation	500 c. y.	$1.00	$1.50
2. Sub-base material, 3-in. and variable	26,485 s. y.	.18	.16
3. Sub-base material, 5-in. and variable	6,605 s. y.	.24	.26
4. Sub-base material, 5-in. min. in rock	14,750 s. y.	.36	.35
5. Dry-bound macadam	600 c. y.	6.00	6.50
6. Bituminous prime coat	19,000 gal.	.13	.13
7. 7-in. dry-bound macadam	9,250 c. y.	5.50	6.00
8. 2 in. surf. course, tack coat	2,730 gal.	.10	.12
9. Aggregate, 2-in. surf. crse	2,390 ton	6.20	6.55
10. Bitum. mat'l., 2-in. surf. crse	145 ton	17.00	23.00
11. Aggregate, 2-in. surf. crse	4,400 ton	6.20	6.55
12. Bitum. mat'l., 2-in. surf. crse	264 ton.	17.00	23.00
13. Aggregate, 2½-in. surf. crse	1,080 ton	6.20	7.00
14. Bitum. mat'l., 2½-in. surf. crse	65 ton	17.00	23.00
15. Bitum. mat'l., seal coat	13,910 gal.	.10	.12
16. Cover aggregate, seal coat	385 ton	5.00	10.00

How capacity and tractor speed effect

SCRAPER PRODUCTION

For obvious reasons, the following LaPlant-Choate scraper yardage table is *not* intended for estimating specific jobs. Its main purpose is to give you a conservative measuring stick for figuring the relative advantage of higher tractor speeds, or larger scraper capacities, on various length hauls. As such, we hope you will find it helpful in estimating the size, type and number of tractor-scraper rigs you will need for your post-war dirt-moving projects. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa.

ESTIMATED PAY YARDS PER HOUR WITH PRESENT LaPLANT-CHOATE SCRAPERS*

Scraper Model	Tractor Size	Struck Yds. Per Trip	Load, Dump	Turn & Time	Length of Loaded Haul in Feet								
					250	500	750	1000	1500	2000	3000	4000	5000
74	D-7	9.5	2.5	min.	122	100	83	69	58	47			
84	D-8	13.6	2.5		145	117	97	88	64	50	41		
86	D-8**	15.3	2.5		175	130	109	98	74	58	51	46	
104	D-8**	25	3.5			172	148	123	100	88	70	55	45
W-10	DW-10**	8.75	2.5			125	102	92	88	81	73	64	54

*Based on a one-way haul on level grade with good dirt and well maintained hauling roads. (54 minute hour used to allow for unpredictable losses). Above figures will change considerably depending on the type and condition of the material you are loading. They also will vary with the condition and grade of the hauling road. Proper maintenance of hauling roads increases production, decreases maintenance on equipment and gets the job done quicker.

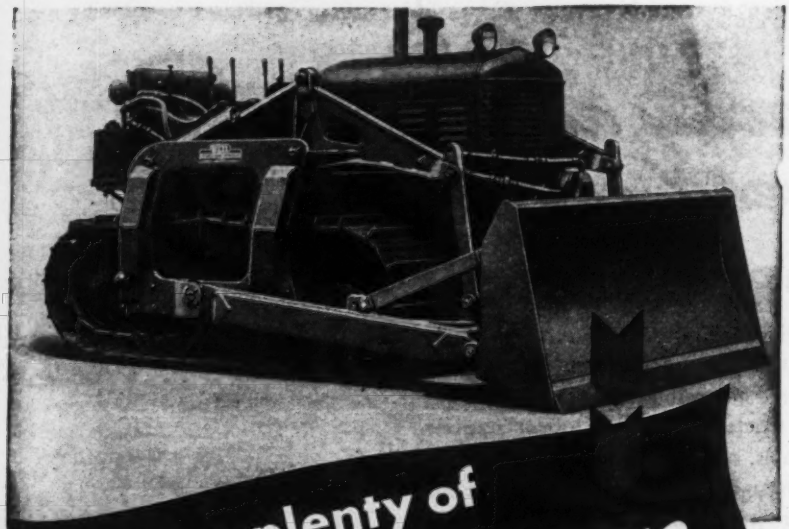
**Indicates pusher loading. In figuring operating costs per cubic yard of material on different length hauls, the operating cost of the pusher unit should be pro-rated and added to the operating cost of each scraper unit. You will find that one pusher can load 3 to 5 scrapers, depending on the length of haul.

A Word About Tomorrow's LaPlant-Choate Scrapers

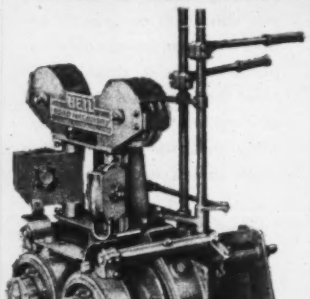
With tomorrow's LaPlant-Choate cable scrapers, you'll be able to get full loads faster and easier in all types of soil, including sand. In addition, you can count on greatly reduced weight, lower cable expense — plus a clean, open bowl that's free of overhead obstruction, for greater stability and for easy loading under shovel, drag line, or bin.

LaPLANT-CHOATE

Earthmoving and Land Clearing Equipment



When plenty of
Down Pressure
is required . . .



Dependable Power Control Units for All Makes of Tractors

Smooth-operating brake and clutch assemblies eliminate shocks and jerks; the large drums run cool; the sheaves are designed to reduce wear on cables. Fingertip control gives lightning-fast response for bigger yardage. They're designed for use with cable scrapers or other cable-operated equipment on all makes of tractors.

Write for bulletins.

Heil Bulldozers
handle the toughest assignments with ease

Heil's fabricating experts have designed this hydraulic bulldozer to give you effective down pressure in hard pan, frozen ground, or rock-imbedded earth. Here is combined simplicity of design and rugged construction to assure outstanding performance.

This widely-used Heil Bulldozer is designed to work integrally with Cletrac tractors with no unusual or severe twists or strains on the tractor at any point. Balanced loads, backed by full length crawler drive, result in effective digging and dirt-moving performance, plus big savings in maintenance cost on both blade equipment and tractor. Enjoy maximum work and satisfaction with a Heil Bulldozer . . . designed and engineered to move "pay dirt" quickly, easily and economically. R-28

SEE YOUR CLETRAC TRACTOR DISTRIBUTOR

ARMY E NAVY

THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

NEWS OF THE WEEK

(*Continued from page 73*)

Inter-American Highway may be opened in 1946

The Inter-American Highway will open for all-weather tourist traffic October, 1946, if the war comes to a sudden end; and in any event not later than a year later, according to Philip B. Fleming, Administrator of the Federal Works Agency. Together with Thomas H. MacDonald, commissioner of public roads, and E. W. James, chief of the Inter-American Regional Office of the Public Roads Administration, General Fleming returned recently from a several weeks' inspection of the road.

Approximately 400 miles of the highway remain to be completed. Of this amount, the general pointed out, 200 miles is southern Costa Rica and western Panama. The rest includes sections in southern Mexico totaling between 200 and 300 miles. Portions of the route passable only in dry weather now total up to less than 300 miles.

The general and his party covered all but 162 miles of the 3,356-mile highway by conveyance other than air. They found only a few United States tractors employed on the highway. Largest contract held by an American firm is that for construction of 70 miles of the road in southern Costa Rica. This work is being done by Ralph E. Mayes, Roanoke, Va. It is not anticipated, General Fleming stated, that any additional contractors from this country will be needed on the job.

Engineers originally estimated that extensive slides would occur on about 20 percent of the highway, and that is just about what they are getting, the General reported.

In commenting on the work of the Corps of Engineers, which was handled by the U. S. War Department some months ago, General Fleming said the Army Engineers had done good work. They were just getting into their stride when they had to leave, he stated.

• • •

Roadside shrub planting to honor Texas veterans

The Texas Highway Commission has endorsed a plan to make statewide horticulture and roadside planting a living memorial to Texans who have served in the armed forces.

The program calls for planting in

trees and flowering shrubs. A county, for instance, might choose redbud as its official shrub and each and town yard would have at least redbud plant. Nurserymen have ed to furnish plants at a minimum and to replace at half price any ed within six months. Jac L. Gub- state highway department land- expert, is a consultant for the mittee.

• • •

Conditions are improved in congested areas

orrington Gill, director of the Com- ee for Congested Production Areas the Executive e of the Presi- has named esentatives for new regions, gnated as con- ed areas since influx of war kers. LeRoy erson will be esentative in kegon and Ot- a Counties in higan, with headquarters at Muske- where there are more than fifty war nts. Paul A. Martin will go to Key st, Fla.

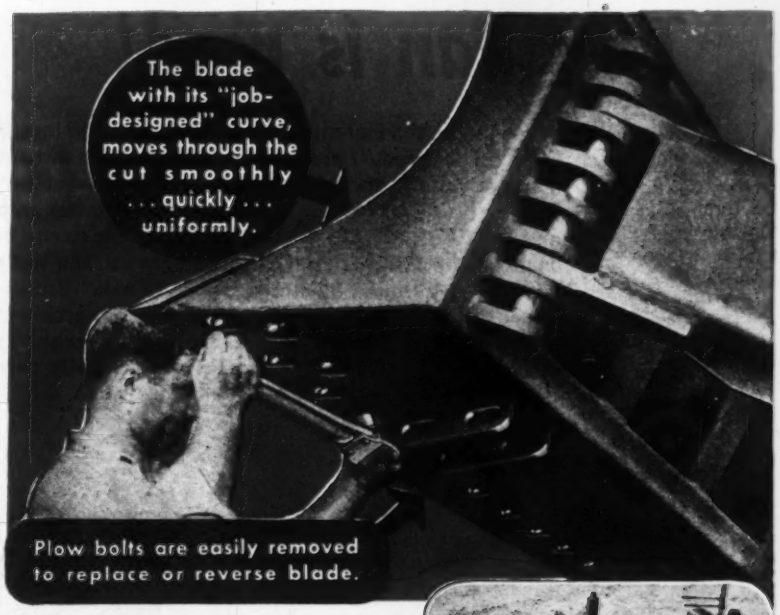
Le Roy Peterson

Mr. Peterson has been serving as a mber of the Washington staff of the mittee. Prior to that service, he was director in New York City of the Manpower Commission. Mr. Mar- has served as representative in sev- l congested areas in the southwest. The representatives' first task will be heck the adequacy of various facili- and report any need for construc- . They will check on sanitation, sing, schools, and transportation.

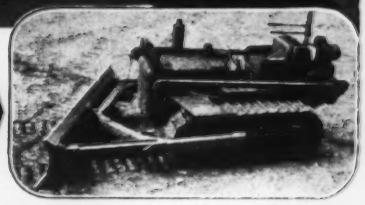
The function of the committee is to edite, stimulate, and coordinate the ivities of vari- governmental ncies in reduc- congestion in duction areas. nstruction is e by federal or er governmen- agencies. Many es construction jects also are dertaken by pri- te enterprise.

Paul A. Martin

The usefulness of the committee to various communities in which it has ctioned is indicated by the fact that has received no criticism but much mmendation. A recent letter from rmes Gautier, president of the Pas- goula-Moss-Point Chamber of Com- rce in Mississippi, said that the com- ttee is helping us to make our com-


The blade with its "job-designed" curve, moves through the cut smoothly ... quickly ... uniformly.
Plow bolts are easily removed to replace or reverse blade.

You get more *drive*... more *penetrating* power at the blade—with HEIL



Cable Dozers

Move more "pay dirt" with each load — quickly — economically

Doing a clean-cut job — cutting at just the depth desired — cutting accurately and smoothly with no washboard or gouged grade — these are features of Heil Cable-Dozer performance. End-tilt adjustments are easily and quickly made — angling the blade merely involves the removal of a pin in the side member, adjusting blade, and replacement of pin.

Heil Cable Dozers are engineered throughout for "tops" in performance and "savings" in your pocketbook. You're money ahead when you specify Heil Cable Dozers. R-27

Write for bulletins.

Definite "plus" features are responsible for the "plus" performance of Heil Cable Scrapers

In improving scraper performance, Heil engineers developed fundamental design changes, such as scientifically located draft pivot point—tilting floor push-out—contoured bowl design—all-welded box sections — etc. These improvements add up to bigger yardage at lower cost—and earn a reputation for "on-time" performance. Write for bulletins.

SEE YOUR INTERNATIONAL TRACTRACTOR DEALER

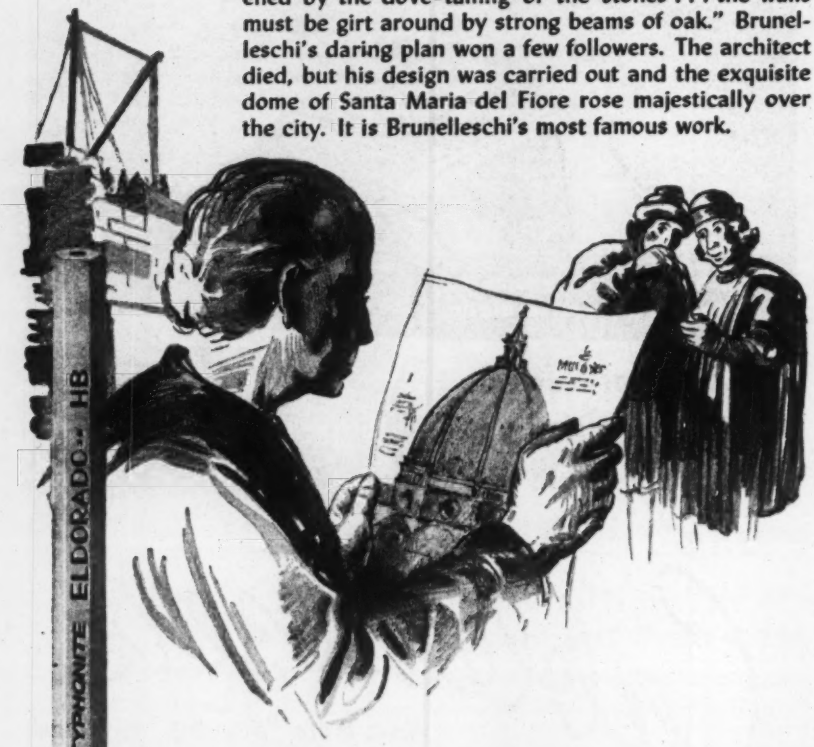
ARMY E NAVY

THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

The man is mad!

Brunelleschi, the Florentine architect, was called insane when he declared, "I propose to raise a cupola without a center column and without any framework whatever. It must be turned in the manner of the pointed arch and must be double . . . the building must be strengthened by the dove-tailing of the stones . . . the walls must be girt around by strong beams of oak." Brunelleschi's daring plan won a few followers. The architect died, but his design was carried out and the exquisite dome of Santa Maria del Fiore rose majestically over the city. It is Brunelleschi's most famous work.



Drawing pencils are tools which transform daring ideas into tangible designs. Typhonite Eldorado pencils are master tools. Whatever the point—needle or chisel—Typhonite Eldorado is the easy, pleasant-to-use pencil that makes the line or figure crisp, sharp, firm, clean. Result? The job is better and the day made brighter for all hands.

Write for Your Complimentary Copy

"I Shall Arise"—a portfolio of Typhonit Eldorado pencil reproductions by Samuel Chamberlain. Subjects are buildings of art and historical importance bombed by the Luftwaffe.

TYPHONITE

ELDORADO

PENCIL SALES DEPARTMENT 27-J5

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

munity livable under stringent war conditions and has laid the foundat for the building of a modern munici ity at least five times our original si

• • •

Three California rivers scouring their own silt

As the result of dredging the le Sacramento river in connection w California's Central Valleys proj three of the state's rivers, whose ch nels were ruined through reckless w of natural resources in gold rush d may once more become navigable deep water vessels.

Filled with silt in the 60's by draulic mining, the American, Y and Feather rivers, which empty i the Sacramento, are today "scouri themselves back to their original ch nels. In places the silt has drained of the rivers as much as 17 feet be the levels of recent years, so it is ported.

• • •

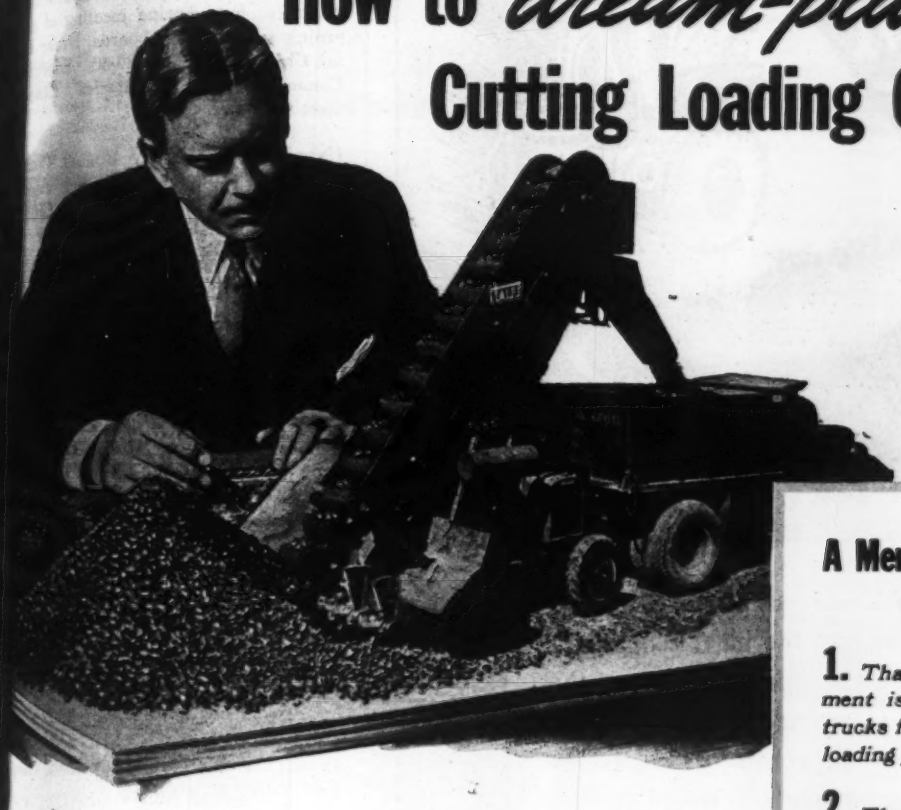
No toll to be collected on Westchester parkwa

Plans of Westchester County, N. to collect tolls on its parkways have b to be abandoned because of objecti of the federal government to the coll tion of tolls on highways built wh or in part with federal-aid highw funds. The county had planned to le tolls on two of its parkways—the S Mill River and the Hutchinson Ri parkways—so that out-of-the-cou motorists would help to pay for We chester's $65,000,000 investment in park and parkway system. But t county's hopes for that financial re were dashed recently when the Publ Roads Administration refused to wa its objections to an act of the st legislature authorizing the county collect toll on its parkways.

Between 1933 and 1936, the federa government contributed $1,211,400 t ward extense of the Saw Mill Riv Parkway and $1,150,100 for like exte sions of the Hutchinson River Parkw

In declining to approve the collecti of tolls, even on sections of the parkw to which the federal government ha made no contribution, R. E. Bowi acting Commissioner of Public Roa states that the PRA has always main tained that collection of tolls at "a point on a highway on which federa funds were expended, which would ma it necessary for traffic to pay the toll i order to avail itself of the section o road actually improved with federa funds, would constitute violation of th law."

How to *dream-plan* Cutting Loading Costs...



For one thing, you'll want to use the straight-line method—the continuous digging, lifting and loading by which a Haiss Loader delivers high speed loading capacity at such low cost.

For another thing you'll want mechanical reliability which has been the Haiss Loader's long suit from the very beginning. Simple, functional design, alloy steels, reliable power, heavy-duty clutches and gears—wholly enclosed and running in oil—and general low cost upkeep to which many hundreds of owners can bear witness.

Let us send you catalogs for your advance planning of more efficient loading.

A Memo of Things to be Sure of:—

1. *That your loading equipment is of capacity to keep trucks from losing time at the loading point.*

2. *That your Loader has sure-fire digging capacity—with a positive-acting self-feeding device—and an efficiently slow "Crowding" drive.*

3. *That your Loader has weight, stamina, and reserve power—ability to do a big job and stand up to hard usage.*

It will live up to all these things if it is a Haiss!

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By eliminating the old fashioned Walking-Beam, Novo engineered the ideal Diaphragm Pump. On Novo Diaphragm Pumps, the Walking-Beam is replaced by an Eccentric Drive. This Eccentric Drive means fewer moving parts, shorter over-all length, and less dead-weight. Hundreds of these Novo Diaphragm Pumps have joined up for the duration. "Come Hell or High Water," they can take it! Remember, of all Diaphragm Pumps, Novo is beamless, but ON THE BEAM.

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Also a member of A.E.D.

NOVO ENGINE COMPANY LANSING, MICHIGAN

Please send me Bulletin #167-D on Novo Diaphragm Pumps.

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MEETINGS

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC., spring meeting of governing and advisory boards, Drake Hotel, Chicago, Ill., May 29-30. Executive Committee and Secretaries' Council meet May 28.

UNITED STATES-MEXICO BORDER PUBLIC HEALTH ASSOCIATION, second annual conference, El Paso, Texas, and Ciudad Juarez, Chihuahua, Mexico, May 30-June 1.

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION, special meeting, Palmer House, Chicago, Ill., May 31-June 1.

AMERICAN WATER WORKS ASSOCIATION, annual conference, Milwaukee Auditorium, Milwaukee, Wis., June 13-16.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 52nd annual meeting, Cincinnati, Ohio, June 22-25.

AMERICAN SOCIETY FOR TESTING MATERIALS, 47th annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, Hotel Cleveland, Cleveland, Ohio, July 19-21.

REGIONAL AND LOCAL MEETINGS

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, The Hotel Statler, Boston, Mass., May 18-20.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, 18th annual conference, Lord Baltimore Hotel, Baltimore, Md., May 19-20.

WASHINGTON STATE ASSOCIATION OF COUNTY ENGINEERS, annual meeting, Olympia, Wash., in conjunction with Washington State Association of County Commissioners, May 24-27.

CENTRAL STATES SEWAGE WORKS ASSOCIATION, annual convention, Oshkosh, Wis., June 22-24.

SEVENTH ANNUAL SHORT COURSE FOR SUPERINTENDENTS AND OPERATORS OF WATER AND SEWAGE PLANTS, sponsored by General Extension Division of Louisiana State University, the Louisiana State Board of Health and the Louisiana Conference on Water Supply and Sewerage, Geological Building, Louisiana State University, Baton Rouge, La., June 28-30.

h INSIDE View of the RESSER BELLMASTER

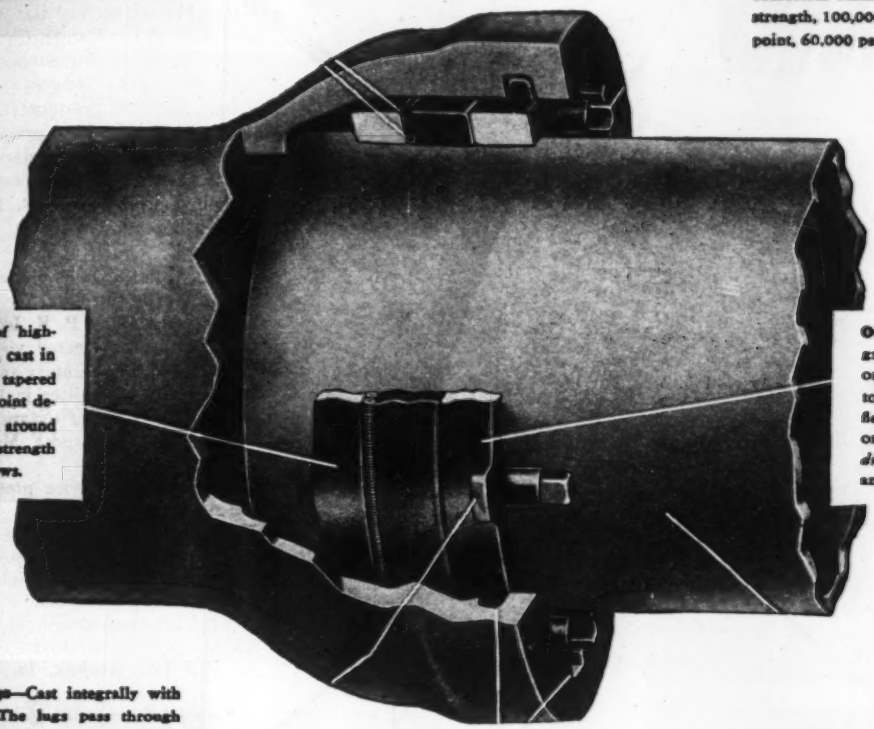
The Right CIP Joint that Fits Inside the Bell

Gaskets—Plain or Armored type gaskets are available, depending on the contents. When ordering, specify service. Gaskets are ¾" x 1¼" in cross-section and are of scientifically compared, resilient rubber compound.

CUTAWAY VIEW

Style 85—Dresser Bellmaster Joint

Capscrews—Cold-upset from special steel and heat-treated for maximum strength. Double-headed: square section for wrenching, and large round section for extra protection against corrosion. Minimum ultimate tensile strength, 100,000 psi. Minimum yield point, 60,000 psi.



Gasket Ring—Made of high-grade malleable iron, cast in one piece. Outside is tapered to permit maximum joint deflection. Extra metal around drilled screw holes for strength and protection of screws.

Outer Ring—Made of high-grade malleable iron, cast in one piece. Tapered on outside to permit maximum joint deflection without metal bending or stressing. Extra metal around *drilled* screw holes for strength and protection of screws.

Locking Lugs—Cast integrally with outer ring. The lugs pass through "slots" in the bell face when the Joint is inserted. The Joint is then turned clockwise until one lug hits the stop in bell groove, preventing rotation of Joint while capscrews are tightened.

Bell End of Pipe—Inner circumference is grooved to accommodate locking lugs. Slots on face of bell permit lug passage. When ordering, simply specify "Bellmaster Pipe."

Spigot End of Pipe—Absolutely plain. No bead, lip, or other special shape required.

pped, Stored, Installed All In One Piece

The Dresser Bellmaster Joint, Style 85, makes cast-iron pipe joining faster and easier than ever before. Light, compact, all-in-one-piece, this mechanical joint is locked into place and tightened—in from 2 to 5 minutes' time. Compression of the resilient rubber-type gasket between two metal rings and against the pipe by cap screws, effects a flexible seal that stays tight even under severe conditions of expansion, contraction, deflection and vibration. Your cast-iron lines are thus protected from breakage and leakage. They may be laid above the ditch and safely lowered in place. The Bellmaster fits *inside* the bell. It is completely enclosed—no exposed parts to chip, break or corrode. Bellmaster pipe can be readily obtained from your regular source of supply. And we are able to ship joints promptly. Sizes 3", 4", 6", 8" 10", 12", 16" CIP. *Catalog 395 AM on reque*

In Canada: Dresser Manufacturing Co., Ltd., 60 Front St., West, Toronto, Ont.

DRESSER MANUFACTURING COMPANY • BRADFORD, PA.

ONE OF THE DRESSER INDUSTRIES

SHAPE
'gives extra strength
plus longer wear-life
As the result of extended research and test, Fuller engineers have modified the time-honored formula for designing gear teeth, in order to produce a shape which reduced the stresses that lead to fatigue and breakage. Proof of the soundness of this engineering departure is found in the performance records of Fuller transmissions now in service, for the different tooth shape has long been employed on Fuller gears. Although the changes in dimensions are, of course, very small, their effect is surprisingly great in extending wear-life. This exclusive tooth shape is available only on genuine Fuller gears, and that is why, should replacement become necessary, you should make sure that the replacement gear bears the Fuller name.
FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin
Fuller
TRANSMISSIONS

WISCONSIN COUNTY HIGHWAY COMMISSIONERS AND WISCONSIN COUNTY HIGHWAY COMMITTEE MEMBERS' ASSOCIATION, jointly with WISCONSIN COUNTY BOARDS' ASSOCIATION, Green Bay, Wis., July 27-29.

Elections and Activities

Robert A. Weinland, of the Union Metal Manufacturing Co., was elected president of the Canton Chapter of the Ohio Society of Professional Engineers recently. Other officers are E. W. Brong, first vice president; Robert Pattison, second vice president; and Charles E. Sperow, secretary and treasurer. Trustees for two year terms are Joseph Yaggi, Donald R. Blythe, and B. M. Bates.

R. S. Gillespie, was elected president of the North Carolina Society of Surveyors, succeeding P. R. Iscoe. F. McCoy Tripp was elected vice president and C. L. Mann secretary and treasurer. A legislative committee includes Grady S. Harrill, Richard Seawell, Weldon Willis, C. L. Mann and F. McCoy Tripp.

E. C. Atkinson, vice president of C. H. Atkinson Paving Co., St. Joseph, Mo., is president of the Associated General Contractors of Missouri, and B. W. Tibbs, Rock Hill Asphalt & Construction Co., St. Louis, vice president. Elected for the fifth consecutive year as treasurer is J. M. Joyce of Cameron, Joyce & Co., Keokuk, Ia.

Russell C. Swank of the Freeland Construction Co., Pittsburgh, is the new president of the Construction Association of Western Pennsylvania.

At the annual meeting of the Halifax, N. S., branch of the Engineering Institute of Canada, it was disclosed that the branch has 237 active members. Officers elected: Chairman, G. J. Currie; secretary, S. W. Gray; auditors, M. Lee and

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All kinds of Structural Timbers and Lumber Pressure Treated with Creosote Oil or
DU PONT CZC Chromated Zinc Chloride
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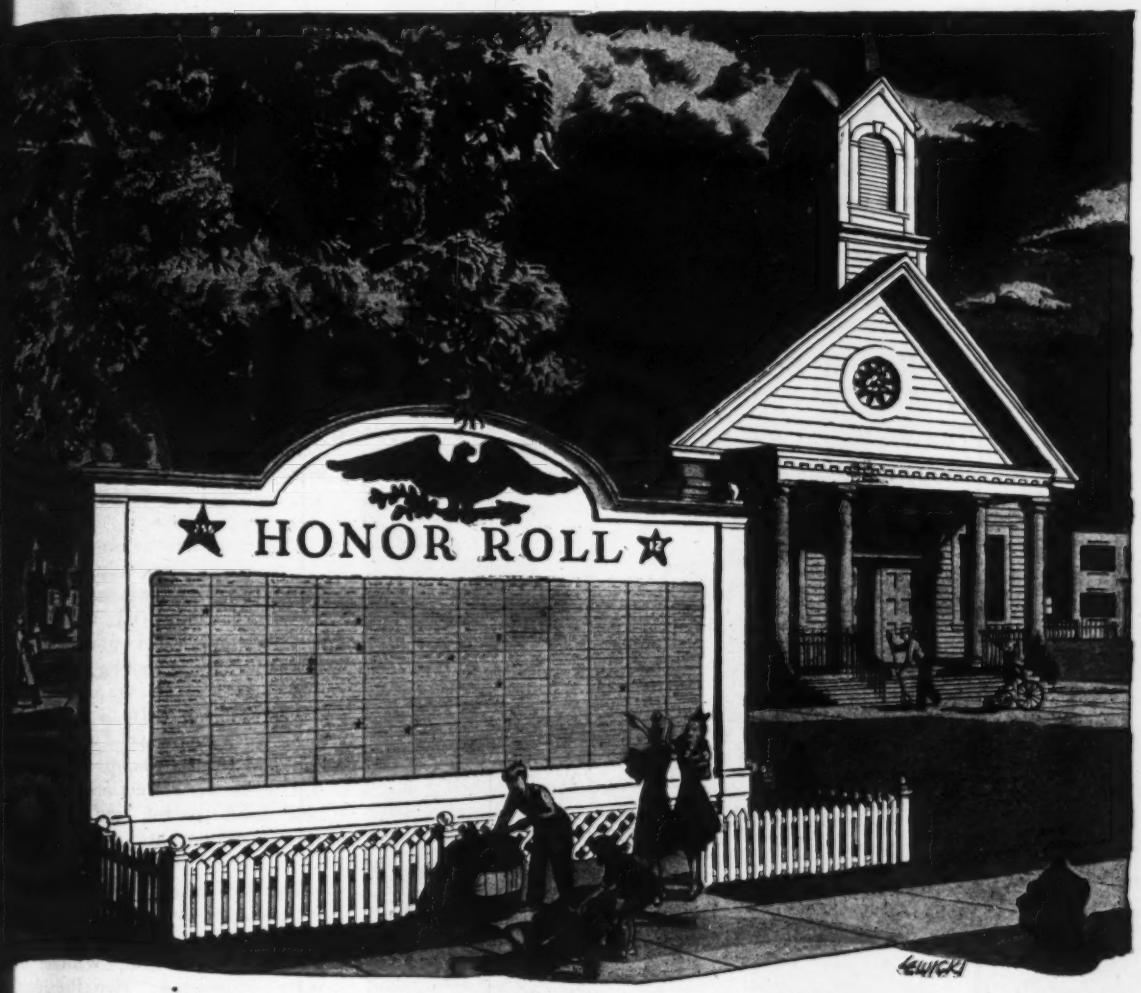

ROM THE HONOR ROLL...TO THE PAY ROLL

WHEN THE VICTORY whistles blow and our boys come home, it's up to every city and town to transfer each man's name from the Honor Roll to the Pay Roll. One way your community can accomplish this is to plan Public Works Programs NOW ... which will give your own men plenty of jobs right in your own home town.

On water supply, sewerage and drainage projects the Lock Joint Pipe Company is prepared to come into your town, set up local temporary plants and employ up to 90% local labor. Your merchants will also benefit through the local purchase of a large quantity of supplies and materials. As a result, a substantial part of the cost of the project will be redistributed in your own community.

The use of Reinforced Concrete Pipe will not only give immediate employment to some of your engineers, mechanics, laborers, and other skilled workers ... BUT it will bring absolute assurance that your pipeline problems of corrosion, tuberculation and maintenance are completely and permanently solved.

Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

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SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

WELLMAN WILLIAMS TYPE BUCKETS

BUCKET QUALITY BACKED BY TWO FAMOUS NAMES

Williams Buckets have been famous for nearly 40 years for their many mechanical features.

Since 1931, Williams Buckets have been built by Wellman, known for many great engineering achievements in the heavy iron-ore, coal, and steel industries. The welded construction which featured Wellman custom-built buckets for extra heavy steel mill service, is now used in all

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FOR LONGER SERVICE WITH LESS MAINTENANCE COST

Built in Multiple Rope, Power Arm, and Power Wheel Types in ⅜ yd. to 18½ yd. capacities.

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Sales and Service Agencies in Principal Cities

Send for Free Bulletin
Tell us about your particular requirement and we will send full description of construction and features in special bulletins which clearly prove why YOUR NEXT BUCKET SHOULD BE A WELLMAN.

Under-Water Cutting Torch NOW for RENT

The improved SWAFFORD electric-oxygen Cutting Torch is now available—for the first time—on an annual rental basis, if the contractor has his own diving equipment. Heretofore this torch has been sold only to the Navy. No hydrogen required. Operated by any experienced diver. Used on many big marine jobs.

We are independent contractors for underwater cutting work. Write for references and technical information.

Swafford & Hancock
Box 566, Batesville, Arkansas

C. Martin; executive, H. A. Ripley, J. W. March and C. D. Martin; executive for outside Halifax, J. H. M. Jones and R. J. Bethune; scrutineers, L. Mitchell and R. M. MacAlpine.

The Master Builders Association, Milwaukee, Wis., elected the following officers: President, Clarence Winter; Vice president, Louis L. Fischer, Treasurer, Anton Winkler; Financial secretary, Alvin Drescher; Secretary, Richard Ferge.

C. M. Greer, of the Little Rock District, U. S. Engineers, is the new elected president of the Little Rock, Ark., Engineers Club, succeeding V. Scott of the Arkansas highway department. Other officers are Werner Knop, vice president and Leonard Caldwell, secretary-treasurer.

The club has selected the following to serve on committees of the Arkansas post war economic council; E. Williams, industrial; Werner Knop, forestry and wood products; V. Buckley, city planning; Tom Harding, housing; R. A. Kerns, public works; Marion Crisp, surveys and research; Ross Landers, minerals; R. Warden, transportation; A. M. Lamb, war plans reconstruction; C. S. Christian, flood control, and M. Z. Black, rural development.

The Wisconsin Concrete Products Association has elected the following officers: President, Herbert Loucks, Madison; Vice President, William Goeringer, Milwaukee; Vice President, C. Jensen, Racine; and Secretary-Treasurer, A. W. Devos, Milwaukee.

Homer A. Hunter, Dallas waterworks superintendent, and J. G. Rollins, local highway engineer, have been named northeast Texas members of the Texas Section, American Society of Civil Engineers, postwar planning committee.

The following were elected directors of the Dayton, Ohio, Builders Exchange for two years; Myron Cornish, Raymond D. Delscamp, Forrest E. Lostroth, Charles H. Shook, William Stoecklein, and Charles Tischer.

Directors who retain their offices another year are: Harry Price, Walter Muth, James M. Kern, E. Creager, Joseph Haverstick, John P. sing, and Richard P. Wuichet. Officers: President, Harry Price, Jr.; V President, William E. Stoecklein; urer, James M. Kern; and R. E. Secretary.

Directors of the Houston chapter the Associated General Contractors America re-elected; E. A. Kruse, ert W. Collins, W. S. Bellows, O. S. Van De Mark.

The "Soap" that *makes metal LAST!*

OAP? What's that got to do with *king metal last* or with red lead paint? Read the data under the photomicro-aph at right and you'll see...

Yes, lead "soaps" undoubtedly explain uch of red lead's remarkable record of eventing rust and corrosion. Their fi-ous, intermeshing structure helps pro-ce a more completely bonded film, having greater toughness, flexibility, adhesion and weather resistance.

That red lead *does* make metals *LAST* is also due to its ability to "inhibit" rust, as attested by the accompanying digest from "Paint Manufacture."

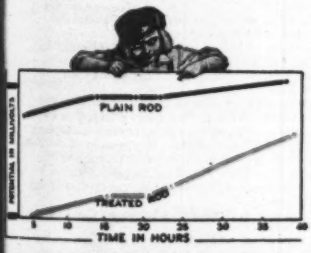
* * *

Money can't buy a better rust preventive than Dutch Boy Red Lead. On industry's toughest jobs Dutch Boy has proved, time and time again, that it is red lead in its most protective form.

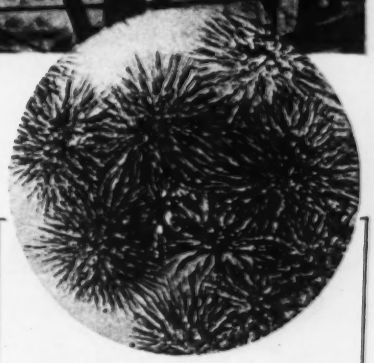
Dutch Boy is made from highly oxidized red lead having a true red lead (Pb_3O_4) content of more than 97% and extremely fine particle size. The result is a smooth, tough protective film that clings tight and is extra-resistant to weather, smoke, dampness, sulfurous gases, salt water and other enemies of metal.

You can obtain Dutch Boy Red Lead as a special *quick-drying* paint, in addition to the standard paste and paint forms. The quick-drying form is invaluable where drying time must be held to a minimum. It dries tack-free in 4 to 6 hours and may be recoated the next day.

Today, write our nearest branch office for your FREE copy of the illustrated booklet, "Longer Life with Red Lead.



A RECENT TEST of red lead's inhibitiveness, re-ted by Dr. A. H. Stuart in "Paint Manufac-e" (Vol. IX, No. 1), a steel rod was immersed thin paste of red lead and water for one hour. e rod was then thoroughly washed to remove pigment, and tested along with an untreated . The treated rod, although all trace of red lead been removed, showed decidedly greater re-ance to rusting, as measured electrically, than the untreated rod.
he above graph shows results of the test. In electrical potential measurement method used. ower point on the scale indicates greater re-ance to rusting. Incidentally, the protective on, while it steadily diminished, had not en-y disappeared after forty hours.



Red Lead in paint combines with the liquid vehicle to produce a distinctive type of metallic soap formation with a fibrous structure consisting of multiple projections radiating from a central core. This photomicrograph shows how these soaps spread out and mechanically reinforce the paint film.

It is also characteristic of "lead soaps" that they allow movement all along their intermeshing projections. This is beneficial to the life of the paint as, once the elastic limit of the dried oil film and the soap particles is exceeded, the soap particles will still "give" in this manner. Such action prevents the ruptures to which a hard, unyielding paint film is subject.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10; Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.).

DUTCH BOY RED LEAD
—makes metal LAST!

Save Metals . . . Speed
Wire Rope Work . . With a
FIST-GRIP

The "Fist-Grip" Clip Has 3 Strikes on Hitler

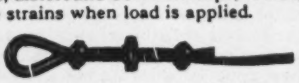
Saves accidents — can't be put on wrong; doesn't weaken rope; greater holding power.

Saves metals—25% fewer clips do the job better; no crushed rope ends; flush nuts—no battered threads.

Save time—fewer clips to put on; nuts on opposite sides tighten easier, faster with any type wrench.

Greater holding power with 25% less clips!

"Finger-Pinch". U-bolt clips unavoidably crimp, distort and bow wire rope, causing reverse strains when load is applied.



"Fist-Grip". Fewer Safety Clips hold rope straight in smooth, vise-like grip, with no protruding threads to get battered in use. Clips and rope can always be used on the next job.

Distributed through
Mill, Mine, and Oil Field Supply Houses
Look for Laughlin Products in Powers' Road & Street Catalog
FORGING A SHARE IN VICTORY

THE THOMAS LAUGHLIN Company
PORTLAND 6, MAINE

MEN AND JOBS

(*Continued from page 71*)

Maupin Wall, of Asheville, N. C., has been promoted to major from captain at Jacksonville, Fla., where he is with the Army Engineer Corps. He received his engineering degree at the University of Florida.

Richard S. Podolske, has been re-elected city engineer of Watertown, Wis.

James C. Duckworth has been appointed city engineer at Coffeyville, Kan., succeeding the late E. L. Brown.

Thos. E. Riley, Worth County, Ia., engineer at Northwood, has resigned to become county engineer of Wappelo County at Ottumwa.

C. F. Merten has returned to his position as Hancock county engineer at Garner, Ia. He has been with the armed forces.

Col. W. W. Wanamaker, district army engineer at Denison, Tex., since August, 1941, has been assigned to foreign duties.

George Henningsen has resigned as acting county engineer at Marshalltown, Ia., and has become connected with the Gibbs-Cook Tractor and Equipment Co. at Des Moines.

Claude H. Helms, town manager of Tryon, N. C., for the past 12 years, has become town manager of Morganton, N. C., succeeding Chester F. Lewis, now a major in the Army Air Corps of Engineers.

W. Watters Pagon, chairman of the master plan committee of the Baltimore, Md., City plan commission, has become an engineering consultant of the downtown committee specializing on highway matters.

Thomas B. Henry has become a partner of Harvey J. Jones of Toledo, Ohio, and the engineering practice formerly carried on under the name of H. P. Jones & Company, will be continued by the new firm of Jones & Henry in the Toledo Trust Building.

The Downtown Authority, St. Paul, Minn., a group formed to develop the central business district, has employed Raymond Loewy Associates, of New York City, to produce a plan with recommendations for structural improvements. **Leon Hyzen,** civil engineer, will represent **Mr. Loewy** during the five month period of the survey.

Here Is Your Nearest Worthington Distributor

For Sales, Rentals and Service on BLUE BRUTE Portable Compressors, Rock Drills and Air Tools.
See full page ad page 129

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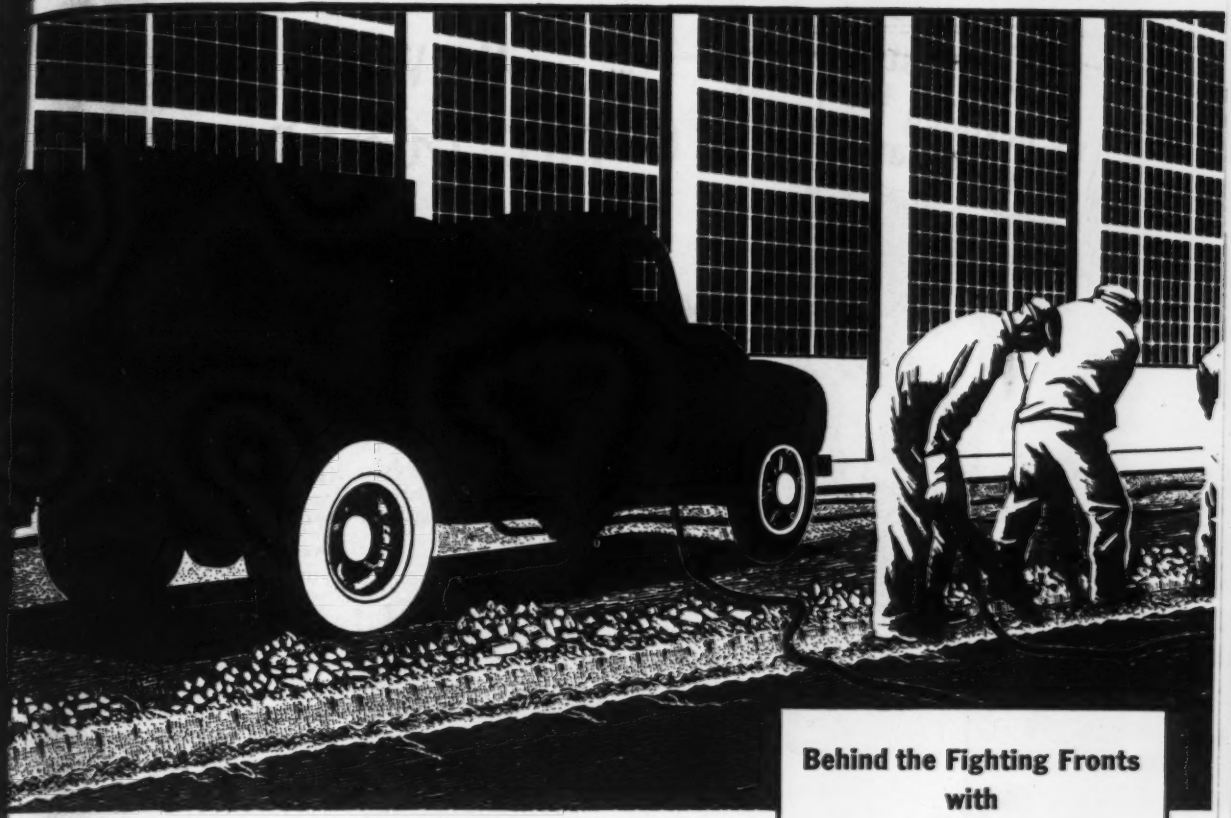
VIRGINIA
Richmond — Highway Machinery & Supply Co.
WASHINGTON
Seattle — Star Machinery Company
Spokane—Andrews Equipment Service
WEST VIRGINIA
Fairmont — Interstate Engineers & Constructo
WISCONSIN
Eau Claire — Miller, Bradford & Risberg Compa
Green Bay — Nelson Machinery Company
Madison — Western Equipment Company
WYOMING
Cheyenne — Wilson Equipment & Supply Co.

Get more WORTH from air with WORTHINGTON

Buy Blue Brutes

Worthington Pump and Machinery Corp.

...E BRUTES FOR POST-WAR WATER WORKS



...u "come from Missouri" — see Brutes. This truck-mounted com- will back your bid on post-war ts like this one:

...6-year betterment program out- ...ned by the Chief Engineer and ...uperintendent, Kansas City Water ...epartment, including a $2,933,000 ...eferred expenditure for work inter- ...upted by the war.

...ndreds of post-war plans are ready for highways, buildings, bridges, ...mprovement! In water works and ...ge alone, $400,000,000 to $600,- ...00 is the estimated annual figure for ...ation, immediately post-war. You'll Blue Brutes your best bets to air- the jobs.

...pendable — their Feather Valves* prevent the lost-time troubles other valves are apt to cause. Blue Brute compressors deliver more air, continuously, by easier breathing.

Trouble-free—three-point suspension on chassis protects engine and compressor from misalignment due to distortion of chassis on rough going.

Economical—less maintenance time, fewer delays on the job can save big money when time is your contract's essence. This too: Worthington Blue Brute air tools use less air; modern design and easy-handling strength make them top-raters on your "air power team."

Investigate Blue Brutes, right now, for that rush job today, and that still bigger job planned for the future! Your nearest distributor is listed on page 128.

Behind the Fighting Fronts with

BLUE BRUTES

Broken cities, like Naples, need compressed air power for reconstructing public services. Blue Brutes, in "uniforms" of olive drab, are part of Engineers' battalions overseas, part of Sea Bees' equipment, too, in battleship gray. From Arctic Circle to the tropic sands — and here at home in camps, bases, ordnance plants — Blue Brutes are with the men who now are fighting for the right to build a free America.

PC4-8

...S. Pat. Off.

...T MORE WORTH *from air with* WORTHINGTON

BUY BLUE BRUTES

...from 60 to 500 cu. ft. capacity in mount- ...ll jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTH BEHIND THE NAME WORTHINGTON

Worthington Pump and Machinery Corporation Construction Equipment Division, Holyoke, Massachusetts

"It won't cost us anything for maintenance"

APS Protected Steel Sheets are ready to apply the minute they arrive. They are protected with a durable, attractive finish that does away with painting after erection, and they are maintenance-free for years! A P S is Weather-Tested, to withstand acid fumes and gases, as well as exposure to salt air, or extreme heat and cold.

PROTECTED STEEL PRODUCTS

General Office and Plant, WASHINGTON, PA.

NEW AIDS TO THE CONSTRUCTOR

Concrete Finishing Screed

A new vibratory principle is built into a new concrete finishing screed, which is said to speed placing, improve finishing and save cement. Available in 6, 10, 13, 16, 20 and 25-ft. models, adjustable in width, this screed, it is claimed, finishes up to 6,000 sq. ft. per hr., with no additional vibration needed.

Gas-powered models use a 1½ hp. air-cooled, varaible-speed Briggs-Stratton gasoline engine; electric models are powered by two ½ hp. Master electric motors.—*Master Vibrator Co., Dayton 1, Ohio.*

• • •

Bulldozer-Trailbuilder

Two new models of the cable-controlled bulldozer-trailbuilder known as "Centro-Lif" are available, one weighing 5,855 lb. and one 5,140 lb. without power control units. Both are controlled by Buckeye single or double drum power control units, and are engine-mounted, with the cable carried overhead from winch to moldboard.

The center lift construction of the moldboard is said to provide such advantages as light weight, simple construction and straight blade lift; it can be easily tilted by the double trunnion mounting of the push arms. The trailbuilder moldboard is 12 ft. 9⅝ in. long and 37⅞ in. high, and is fitted with reversible cutting edge and replaceable corner bits.—*Buckeye Traction Ditcher Co., Findlay, Ohio.*

• • •

Truck Crane

Departing from usual design, and thoroughly tested, a new heavy duty P&H truck crane features a carrier built for crane work, according to the manufacturer's announcement. Without outriggers, stability is assured by the low center of gravity; with outriggers, which require little blocking, the working range is proportionately increased. The new weave-proof frame of welded box section, with built-in torsional bar, lessens sway at the boom point.

This truck crane's operation is independent of carrier power, with either gasoline or diesel motor. The unit is within standard road clearances, and has a comparatively short wheel base. It can be equipped with hook, clamshell, magnet or dragline.—*Harnischfeger Corp., Milwaukee, Wis.*

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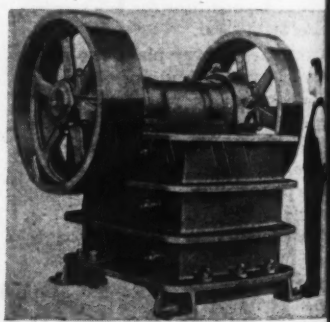
Jaw Crusher

Some novel and desirable improvements have been incorporated in a new 18x32-in. Telsmith roller bearing jaw crusher. This crusher has a solid cast steel frame and swinging jaw, which,



is said, prevent weaving or cracking.

Low upkeep is another advantage claimed for this new crusher.—*Smith Engineering Works, 532 East Capitol Drive, Milwaukee, Wis.*

• • •

Blueprint Evaluator

Scarce materials, man and machine hours and personnel will be saved, it is claimed, by a new Legimeter—a device to predetermine whether a drawing will reproduce satisfactorily. The Legimeter

ADAMS MOTOR GRADERS SEE

Action at Tarawa

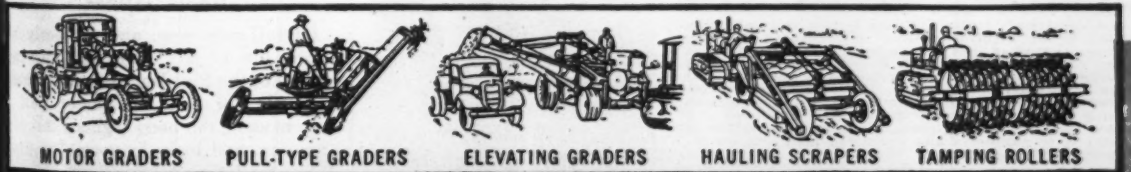
For concentrated fighting and high casualties, few battles in American history can approach Tarawa. Burrowed deeply into the earth, the Japs resisted fiercely the determined attacks of U. S. Marines. In the end the enemy were wiped out almost to the last man but only a few hundreds of the attacking force escaped death or injury.

Scarcely had the shooting stopped when Adams motor graders, in the hands of the Seabees, ran ashore to clear away the rubble left by the battle. Within a few days after the Marines landed, the motor graders had completed the air strip pictured above thus establishing another advance base from which our planes can operate.

This is just another example of how not only Adams motor graders, but Adams leaning wheel graders, elevating graders and tamping rollers are in the thick of the fight in the hands of the Army and Navy throughout the world—performing with characteristic dependability. While our brave sons and brothers carry the fight forward on foreign shores let us back them to the limit on the home front to hasten the day when they can return to their normal peacetime pursuits.

J. D. ADAMS COMPANY • INDIANAPOLIS, IND.

At war's end we'll need many new roads and many jobs for returning service men. Plan post war projects now and meet both needs.



ADAMS ☆ ROAD-BUILDING AND ☆ EARTH-MOVING EQUIPMENT

Cuts Operator's Time to 5 Minutes

HERE is another exclusive improvement added to Refinite Solo Valve controlled water softeners—the Refinite Salt-O-Matic Brining System (pat. pend.). With it regeneration is reduced to these simple operations: (1) At end of softening run operator sets valve for backwashing. (2) When alarm Bell signifies end of backwashing, valve is placed in brining position. (3) At end of brining, alarm rings and solo valve is placed in service position. No other valve adjustments are needed. Actually, during the entire regeneration process, less than 5 minutes of the operator's time is required.

Refinite, manufacturers of quality water conditioning equipment, will gladly discuss your water problems with you. Write Refinite today. There's no obligation.

The Refinite Corporation

Write for free catalog. Since 1917 **102 Refinite Bldg., Omaha, Nebr.**

PREVENT RUSTING

Like hundreds of others, your steel tanks too can get lasting protection against rusting with Rusta Restor. Not a "Magic",—but the proven cathodic (i.e. electrical) method, Rusta Restor maintains the tank in an "electro-negative" state, which not only prevents rusting, but gradually removes the effect of any earlier rusting. Rusta Restor is modest in first cost,—and uses the current required by only one light bulb,—at safe, low voltages. Each installation engineered to the individual tank and water conditions using proven mathematical formulas developed and used only by our engineers. Detailed description of interest to engineers and operating men sent on request. Write today.

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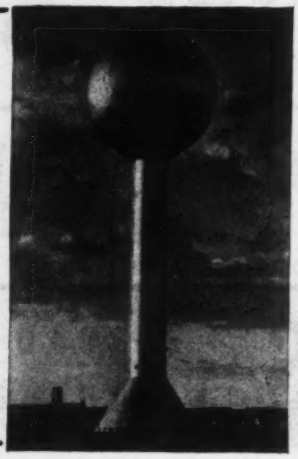
860 Addison Rd. Cleveland 14, Ohio



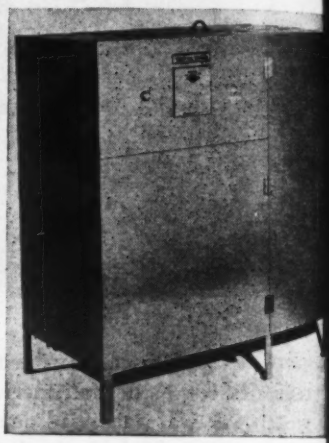
is a two-panel illuminated table. Samples of drawings from which satisfactory prints have been made are mounted on the first panel; the second panel is a clear sheet of ground glass on which the draftsman places the drawing to be evaluated. Both panels are illuminated by transmitted light of the same intensity, for accurate comparison.

The Legimeter includes additional devices for the training of inexperienced draftsmen.—Invented by *Douglas Wishart, The Glenn L. Martin Co., Baltimore, 3, Md.*

• • •

Continuous Oil Reclaimer

Readily available refinery earths may be utilized for cleaning oil with the new YM "Robot" continuous, automatic oil reclaimer, according to the manufacturer's statement. The machine removes fuel dilution, acids, solid and colloidal



carbon, dirt, etc., and restores oil emulsified by water. When piston varnish and sludge deposits are present, the manufacturer offers a guarantee to remove them and prevent recurrence.

A single machine can serve an entire large or small power plant. Ability to restore transformer oils to 30,000 volt dielectric strength is also claimed for this machine.—*Youngstown Miller Co., Sandusky, Ohio.*

• • •

Dump-Trailer

Of roll-over type, and perfectly balanced for speedy dumping, two new models of the Phil-Dump trailer are now available, for hand or tractor pull. In both models, the body rights itself after dumping, and locks in normal position.

The trailer model, 1 cu. yd. capacity, may be quickly coupled to any factory tractor, and the load dumped by means of a chain control, without the operator leaving the tractor seat. The ¾ cu. yd. hand-pull model is equipped with roller bearing plastic wheels for floor protec-

wo wheels are fixed and one swiv-
Phillips Mine & Mill Supply Co.,
ne St., Pittsburgh 3, Pa.

. . .

ncrete Reinforcing Bar

tifically designed to give the
t possible bonding value between
e and steel, a new concrete re-
g bar, Inland Hi-Bar, permits
ed load transfer, accomplished
ns of reversed double helical ribs
per height, extending between

cally opposed longitudinal ribs.
bar, the helical ribs are spaced
intervals, and, because of their
ns, provide potential bearing
aring areas which have the
elationship to each other and
ectly proportioned to the effec-
ngth of the bar. The bearing
more than double than that of
r types, it is claimed.—*Inland*
. Chicago, Ill.

. . .

stic Window Screen

ion resistance is the outstand-
re of new plastic screen, the
turer states, under conditions of
nidity, salt air and spray, and
s, light transmission and visi-
nain constant, it is claimed, ex-
re soot or other foreign mate-
umulate; then the screen may
-cleaned or washed with soap
er.—*The Dow Chemical Co.,*
Mich.

. . .

Three-Way Valve

mplified design and quick ac-
e modern butterfly valve have
lied to a new three-way valve,
604, the manufacturer states.
erchange and mixing service

PRINTS CAN BE O.K.
IN CLARITY, TOO . . . WITH

HI-DENSITY

MICROTOMIC
VAN DYKE
DRAWING PENCILS

Sharp, readable prints that are clean-cut to the finest detail are the standard result of pencil tracings made with HI-DENSITY lead. It is a quality, above and beyond the smoothness and uniformity of grading for which MICROTOMIC VAN DYKE has won acclaim. Ask an accredited VAN DYKE agent to let you test a HI-DENSITY lead...it's worth investigating!

GET YOURSELF A VAN DYKE 20" CIRCULAR SLIDE RULE 25¢ POSTPAID

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For enclosed 25¢, send me your war-time card printed 20" SLIDE RULE.

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DRAGLINE PRODUCTION TIP NO. 4

REMOVE LEDGES THAT WEAR THE CABLES!

TO CUT MAINTENANCE COSTS... DON'T LET LOAD LINE RIDE ON ABRASIVE LEDGES
STEP BACK AND REMOVE LEDGE
THEN RESUME ORIGINAL POSITION FOR DIGGING WITH ALL LINES CLEAR

Experience by hundreds of dragline owners, on every type of work and under all conditions, has proven that *size for size* and *weight for weight* —*a Page Automatic Dragline Bucket outdigs any other bucket made!*

PAGE
Automatic **DRAGLINE BUCKETS**

PAGE ENGINEERING COMPANY, CHICAGO 38, ILLINOIS

are possible with this valve, i pressures from 15 to 900 psi.

This unit is adapted to manua trol as well as power operation a vated temperatures, for which finned, lubricated stuffing boxes a vided. This electric motor operate weighs 8,500 lb.—*R-S Products Wayne Junction, Philadelphia 44,*

• • •

Plywood-Plastic-Metal Pa

A newly developed material co ing plywood, plastic and light metal, known as "Armorply," will possible a revolutionary constr technique, it is believed. The ma serves as framework, sheathing a terior siding or roofing; factor ricated, flat units occupy little sh space and are light in weight.

It is stated that "Armorply" ma

are quickly and firmly coupled t strong, light structures. The flan the metal-bonded plywood pan come either stud, rafter or joist the house is sheathed; the e metal face protects the building rodents, termites, etc.—*Develop MacMillan Clements, United Stat wood Corp., 616 West 46th St York 19, N. Y.*

• • •

Wood Treatment

A treatment applied similarly full-cell process of pressure im tion of lumber has been perfe make lumber harder, more resis change due to moisture, chemic abrasions, and to change wo will not support combustion process uses a chemical agent, lolurea, compounded by addi urea to dimethlolurea. This makes wood much harder than tural state, it is claimed. Pop be made as hard as maple, a hardness of maple increased to ebony, equivalent to that of some Cost of the treatment is said to parable to that of pressure tr creosoting.

To date experiments have been in veneers and thin sections, bu

"LAZY" oil
trap your trucks

. . . hard-working TALPEX keeps equipment on the "GO"

YOU'RE having trouble enough these days keeping your equipment on the move. Then why add to your woes by using a "lazy" oil . . . one that does only part of the job it should? Give your engines a break. Use Shell Talpex.

Many operators who have switched to this hard-working oil find their engines running for longer periods of time between overhauls, and with greater operating efficiency. The reason is simple. A "lazy" oil has only one or perhaps two of the properties necessary to efficient wartime engine operation. Shell Talpex has *all* of the necessary properties.

NEW SHELL TALPEX

IS NON-CORROSIVE to alloy bearings. Protects all lubricated engine parts against corrosion.

HAS EXCEPTIONAL OXIDATION STABILITY. Holds to a minimum the formation of sludge, lacquer and other deterioration particles.

HAS HIGH DETERGENCY. Helps keep carbon, lacquer and foreign particles from adhering to pistons and rings, valves, ports.

HAS LOW CARBON FORMING TENDENCY. Reduces ring sticking and wear. Lengthens engine life.

If the oil you now use doesn't have *all* these properties, it's "lazy" . . . should be changed to hard-working Shell Talpex. Ask the Shell man to show you why.

SHELL

TALPEX

THE NEW, ALL-PURPOSE, HEAVY-DUTY LUBRICANT

For trucks, busses, tractors, shovels, stationary and marine Diesels

BETTER CONCRETE FASTER WITH INTERCHANGEABLE VIBER VIBRATORS

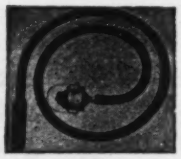
9500 R.P.M. IN CONCRETE

The list of contractors who use Viber equipment, and the projects on which it has been used, includes the outstanding names in the construction world! The complete *interchangeability* of Viber equipment, enabling you to add units as desired, or to change them to suit conditions on the job, is another feature that adds to the efficiency of this job-tested equipment, as well as reducing the investment cost.

AIR

● FLEXIBLE PNEUMATIC VIBRATOR

Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability of flexible casings, cores, vibrators. Operates on 80 lbs. pressure.



ELECTRIC

● FLEXIBLE ELECTRIC VIBRATOR

Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability — Flexible Casings, Cores, Vibrators. Universal type motor. Built-in protective "ground."

GAS

NEW FEATURES "GAS" VIBRATOR

Mercury clutch, entirely automatic, picks up load at 1500 r.p.m. allowing engine to idle without running vibrator, eliminates stalling, makes starting easy in cold weather.

Upsetting is practically eliminated in mounting. Handles allow complete unit to be easily carried.

NEW CATALOG

Illustrates and describes the latest Viber equipment — gives complete data on casings, cores, speeds, power, weight, etc. Also new features. Also list of users and jobs where used. Write for your copy today.

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BURBANK, CALIFORNIA

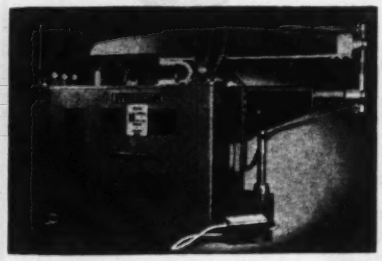
for structural sizes are indicated in increased strength, abrasion, fire resistance and durability. Holding power of nails is said to be higher than for natural wood. Depth of treatment can be varied to make only the exterior hard while leaving the center resilient and shock resisting.—*E. I. du Pont de Nemours & Co., Wilmington 98, Del.*

• • •

Spot Welder For Structural Sections

Structural aluminum sections up to ⅛-in. Alclad may be handled by a new Model "C" rocker arm welder, according to the manufacturer's announcement. Designed to produce 1,000 to 2,000 spots per hour, Model "C" is of extremely rigid construction.

The welder has an adjustable throat



depth from 36 to 42 in., and throat opening from 7½ to 17½ in.; in addition to the normal 1-in. working stroke, the rocker arm has a retracting stroke which provides a 4½-in. clearance between points. The base is 35x66 in., and the overall height a little over 5 ft.—*Progressive Welder Co., 3050 East Outer Drive, Detroit 12, Mich.*

• • •

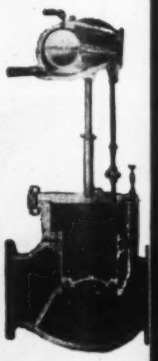
Safety Goggles

Safety, attractiveness and strength are featured in two new AO Ful-Vue safety goggles, the manufacturer announces. These well-fitting plastic goggles are spark-proof and rugged, with a massive front and a deep groove in

the lens rim which forms a substantially backed lens seat to resist impact. They are recommended for "metal-allergic" workers. The nose pads have rounded edges and ample flare to withstand jolts

GOLDEN-ANDERSON CONTROLLED FLOAT VALVES

Maintains adjusted water level within 1" variation. Suitable for closed or open tanks, water basins, reservoirs, etc. May be furnished without self-contained float ball chamber if desired. Sizes 3" to 36".



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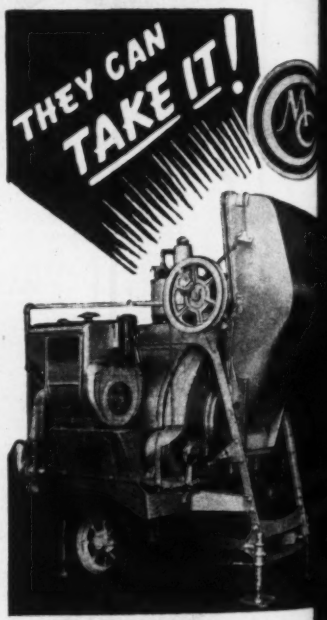
GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG., PITTSBURGH, PA.



Light enough to handle . . heavy enough to "take it". These HIGHLY PORTABLE CMC's have proven their durability and sturdiness on important jobs over the world. They are "first choice" Mixers in peace or war. All standard sizes. Get information.

CONSTRUCTION MACHINERY CO.

Waterloo, Iowa

Mixers • Pumps • Hoists • Batching Placing Equipment • Saws • Carts • Bar

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(NEW CATALOG 7000)

With the new Westinghouse Buying Data, you can select and purchase the proper motor control in half the time.

Data, as presented, is striking in its newness. It's easier to read, easier to understand, and easier to use than any published previously by any manufacturer.

Chances are—if you are a buyer of motors and controls—that you have already received a copy of this new Catalog 7000 by mail. However, if you have not received your copy, write, wire or phone your nearest Westinghouse district office. (Requests will be filled through district offices only — no mailing from Westinghouse headquarters at East Pittsburgh.) J-60551

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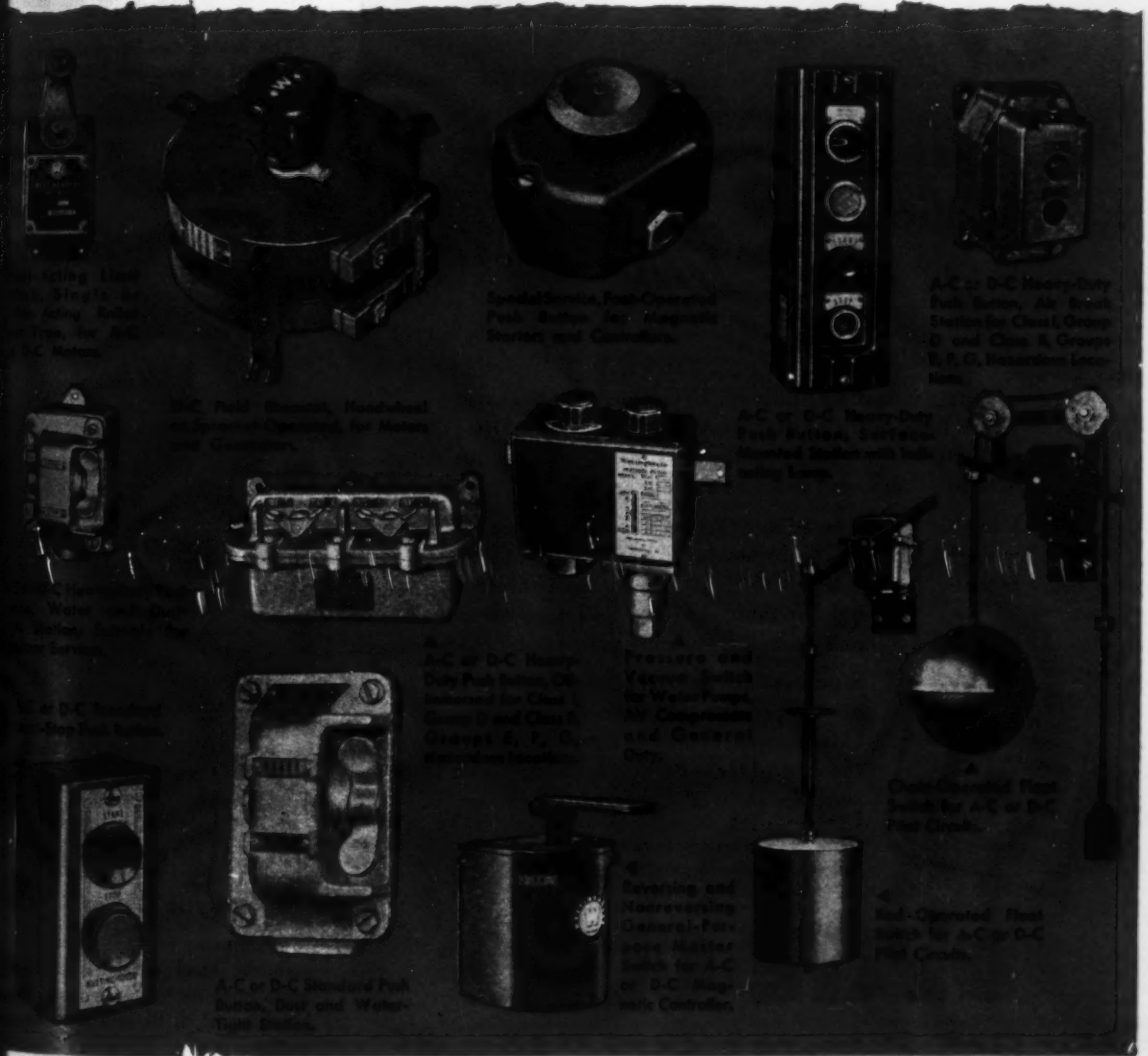
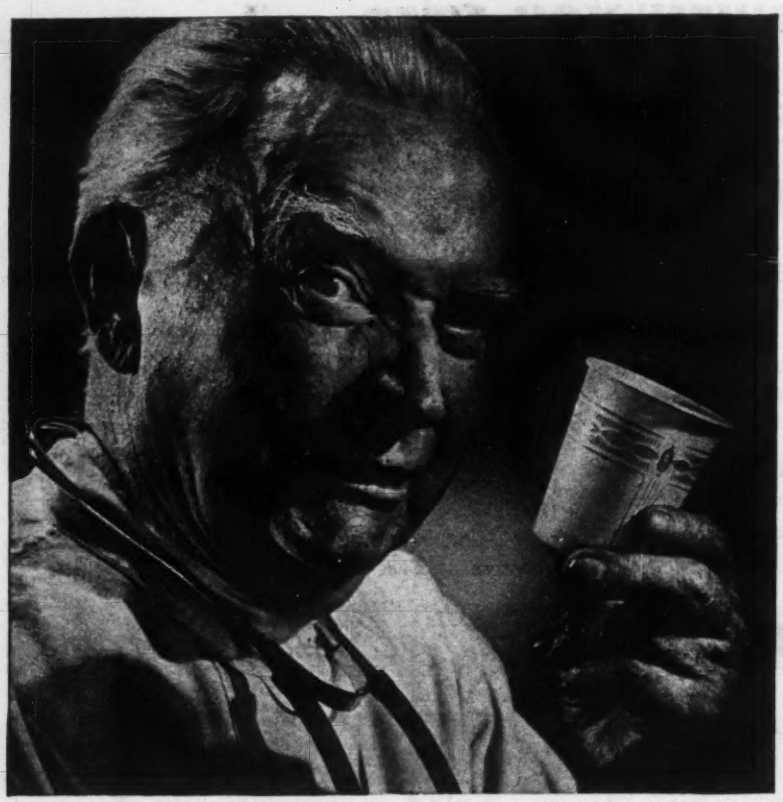
Control Accessories





"greatest little 'cold-stoppers' in the world... DIXIE CUPS"

Of course Dixie Cups won't stop colds once started. But they can help prevent their being passed along to others.

That fact becomes doubly important on contract work where help shortage may prove serious. Use of Dixie or Vortex Cups helps prevent the spread of contagious illnesses that cause sick absenteeism.

Valuable time is saved by bringing water to the worker with the Dixie Portable Water Carrier, instead of having him leave his job to get a drink. Lost minutes quickly multiply into lost hours where no systematic watering plan is adopted.

Workers—particularly American workers—appreciate the cleanliness of individual paper drinking cups... and the thoughtfulness of a management which provides it. ★

Write for descriptive folder giving complete information on this portable water service, including tanks, dispensers and cups.

Dixie and Vortex Cups are made at Easton, Pa., Chicago, Ill., Darlington, S.C., Toronto, Canada.

DIXIE CUPS

DRINKING CUPS AND FOOD CONTAINERS

and blows without pressing into wearer's face.

One of the new goggles is of crystal color, with white or Cal 6-curve Super-Armorplate lenses; second, with side shields, comes green or pink.—*American Optical Southbridge, Mass.*

• • •

Small Heater

To heat small structures and lim areas, a new small, direct-fired h has been developed, with capac ranging from 300,000 to 850,000 output per hour. Floor space req

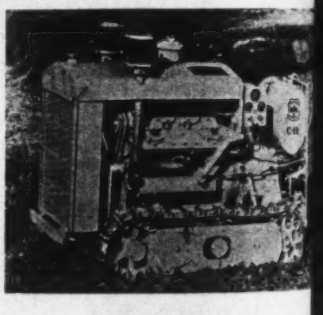
ments are 5¼x3 ft., or the model be suspended from the wall.

The heater can be equipped to either oil or gas; the burners and trols of one type may be removed the other type substituted, if neces The heater is thermostatically trolled.—*Dravo Corp., Machinery sion, Heater Department, 300 Ave., Pittsburgh, Pa.*

• • •

Self-Propelled Compressor

Small and powerful, a new 60 c self-propelled, crawler-type compr can be transported under its own p



in the roughest kind of terrain, claimed. Complete specifications available on application.—*Schr Inc., West Chester, Pa.*

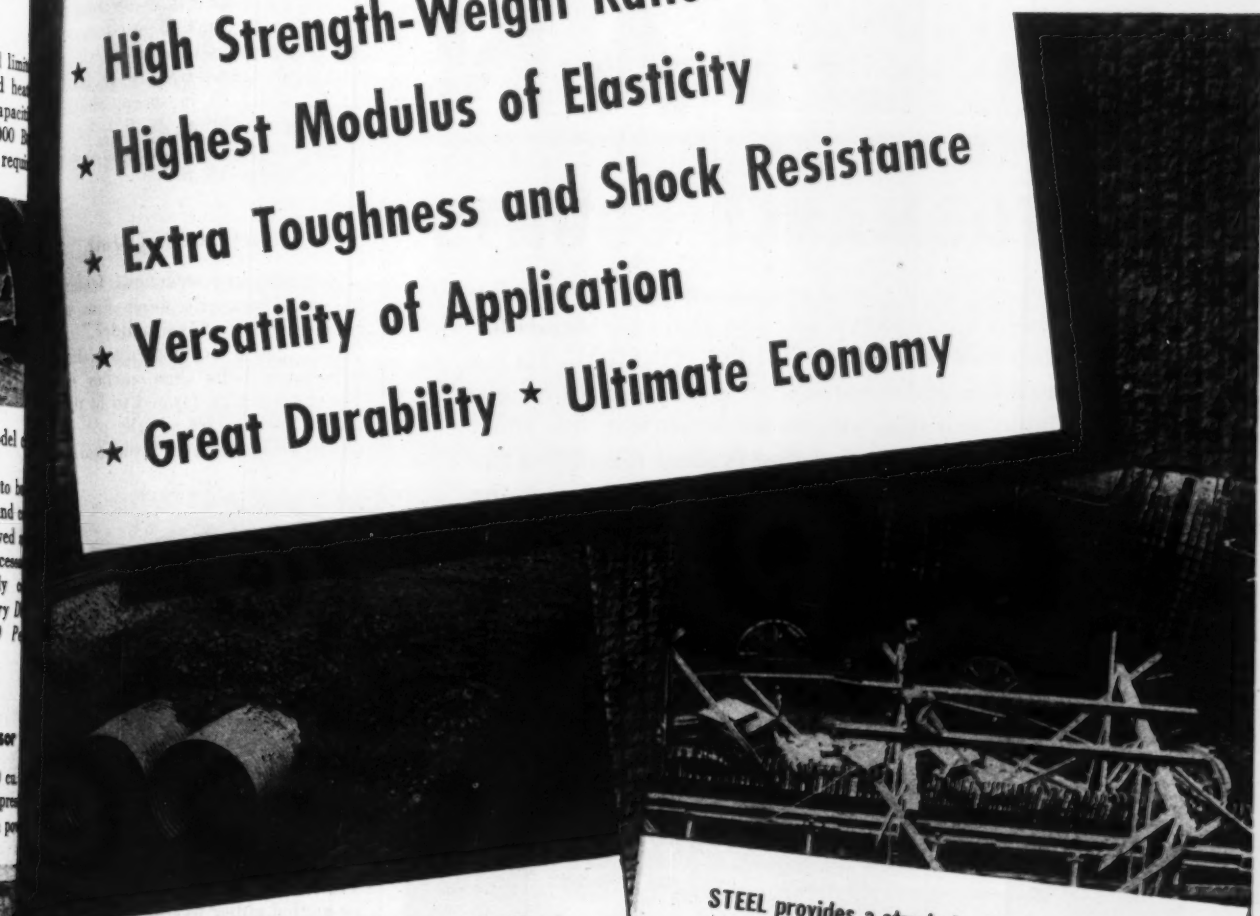
• • •

Electrolytic Removal Met

Aluminum, brass, bronze, copp stainless steel castings and ma parts need no longer be junked d breaking of drills and taps, the facturer states, as the new Mec

six structural advantages:

- ★ High Strength-Weight Ratio
- ★ Highest Modulus of Elasticity
- ★ Extra Toughness and Shock Resistance
- ★ Versatility of Application
- ★ Great Durability ★ Ultimate Economy



STEEL culverts provide low-cost efficient drainage

S Corrugated Metal Pipe combines high drainage capacity with ease peed of installation that makes it superior for the drainage of roads ighways, for railroad right-of-way, for airports and factory wherever ndwater must be run off in a hurry.

ight, strong and easily handled it withstands vibration and impact hout any ill effects. Accidental dropping won't break it, neither will the nding of the heaviest traffic. No time consuming foundations or forms necessary. Even the heaviest plates for large culverts can be easily ndled by ordinary labor and without special tools.

STEEL provides a sturdy backbone for concrete

Add strength and long life to concrete bridge piers, abutments, retaining walls, etc., with U·S·S Concrete Reinforcing Bars. Engineers and contractors have found them the most economical and practical means of obtaining thoroughly reliable reinforcement for all types of concrete construction.

U·S·S Concrete Reinforcing Bars, cleanly rolled from *new* billet steel to standard specifications bear the symbol of the Concrete Reinforcing Steel Institute—assurance that they are made to meet the highest standards of the industry. Our distributors located in all principal cities carry ample stocks of standard sizes to insure prompt delivery.

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PERFORMANCE COUNTS

● **Lower costs of doing the job and lower costs for equipment and upkeep pay you extra dividends for selecting this TROJAN UTILITY PATROL. Its superior design and construction gives you a thoroughly reliable tool that will do more work in less time. A medium weight patrol that is ideal for all but the heaviest jobs. Before you buy a patrol... get the TROJAN story and performance proofs. Address:**

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TROJAN ROAD TOOLS INCLUDE: PATROLS, SELF-POWERED SPEED TAMPERS, DRAWN TAMPING ROLLERS, SCRAPERS

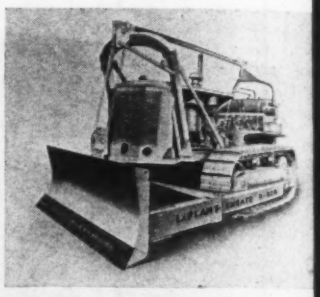
method makes salvage of parts pr able. This electrolytic process di tegrates and dissolves embedded fr ments, but certain blocking agents the solutions prevent electrolytic att upon non-ferrous metals and alloys, a thus make no change in hole or thr dimensions.

A special formula Mechemel solut is furnished for every non-ferrous me and alloy in common use today. T processing cabinet, complete with co plug and accessories, is 14 in. hi 12 in. wide, 10 in. deep, and has shipping weight of 45 lb.—*Mechem Engineering & Sales Co., 4313 Lin Ave., Chicago 18, Ill.*

• • •

Earthmoving Unit

Retaining the structural features the manufacturer's dozer line, a s cable-operated "Trailbuilder," Mo R-82R, has a cutting edge reinfor with more bolts than earlier mode The cutting bits, formed to fit the e of the blade, are single plates. T newly designed front overhead is s



to give increased strength and bet appearance.

Simple and positive to operate, t Trailbuilder's three-position blade c be angled either to right or left, or be in straight bulldozing position. T blade can be raised a maximum of 50 i or dropped 72 in. below the ground li —*La Plant-Choate Manufacturing C Inc., Cedar Rapids, Iowa.*

PERFORMANCE
Packed with POWER

Abundant power with means of applying it efficiently to every need, is a feature of both U.S. aircraft and Owen Buckets.
In Owen Buckets power may be utilized with most efficient performance in every situation through adjustable counterweights and adjustable reeving. Investigate

THE OWEN BUCKET CO.
6010 BREAKWATER AVE. CLEVELAND, O.
BRANCHES. New York, Philadelphia, Chicago, Berkeley, Cal.

OWEN BUCKETS
A MOUTHFUL AT EVERY BITE

F MILES OF

are providing efficient, pendable, economical water sportation throughout the nation

THE THOUSANDS OF MILES of ns-Manville Transite Pipe in serv- today, you will find installations lmost every size and type. In big s, small villages, in military camps bases both here and abroad, nsite Pipe is serving efficiently in transmission and distribution of r.

here are definite reasons for this acceptance. Made of asbestos and ent, Transite Pipe provides these ortant advantages:

Handling. Light-weight Transite requires fewer men for handling. the larger sizes need mechanical lling equipment.

rculation No Problem. Non-me- c in composition, Transite cannot rculate. Its initial high-flow co- efficient (C=140) can never be reduced by tuberculation.

Low Maintenance. Made of asbestos-cement, Transite's corrosion-resistance and maintained strength contribute to its low maintenance costs.

Tight, Flexible Joints. Wide sweeps can be made with straight lengths because the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

Rapid Assembly. Even unskilled crews form tight joints easily, quickly with the Simplex Coupling.

For the complete facts, write to Johns-Manville for Transite Pipe Booklet TR-11A. For details on Transite Sewer Pipe for more efficient sewage disposal systems, ask for TR-21A. Johns-Manville, 22 E. 40th St., New York 16, New York.

NSITE PIPE IS AGAIN AVAILABLE FOR PROMPT SHIPMENT

JOHNS-MANVILLE

Asbestos

TRANSITE PIPE

FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES

JOHNS-MANVILLE JM PRODUCTS

kept FORM costs down!

RICHMOND 10-WAY SAVING PLAN

1—Provides all kinds of form-tying devices to choose from.
2—Economizes because Form Ties cost less to use than wire, bond or rod ties.
3—Supplies Form Ties engineered for safe working loads of 1,500-30,000 lbs.
4—Assures faster erecting and stripping, plus big lumber savings.
5—Promotes perfect alignment for correct wall thickness.
6—Protects job against rust staining with 1 to 3 inch cutback.
7—Saves shipping and handling costs because of scientifically reduced weight.
8—Is only known prevention against termite destruction.
9—Enables you to borrow working parts and to pay only for ties in the job.
10—Is planned from job plans to use the right size of ties and the least number of ties to fit forming for fast, safe work.

SEE OUR CATALOG IN SWEET'S

Whether you are planning, designing or estimating on a concrete job—large or small—there are *Dollars* to be saved on *Form Work* by planning.

Richmond Services to Architects, Engineers and Contractors include recommendations on Form Tying Devices, Consultation on Form problems and Forming used, as well as Estimates on requirements, all without obligation.

The list of big jobs on which Richmond Form Ties have saved on form-work costs and speeded up completion is a blue-ribbon list of modern construction. It includes mammoth projects everywhere—and small contracts, too. There is a Richmond Tie engineered for every type of concrete construction. We plan a Tie to fit the work.

For information, write to our Planning Division.

RICHMOND SCREW ANCHOR COMPANY, INC.
816 LIBERTY AVENUE • BROOKLYN NEW YORK
Established 1911

MANUFACTURERS' ACTIVITIES

E. J. MASLINE, general superintendent of The Union Metal Manufacturing Co. for the past 19 years, has been appointed general manager and a director of Pacific Union Marbelite Co., Los Angeles. The Pacific Union Marbelite Co. is a subsidiary of Union Metal, as manufacturers and Pacific Coast sales representatives for the parent company.

Mr. Masline has been connected with Union Metal continuously since 1941 with the exception of 15 months in 1917-18, during which he served with the U. S. Navy. A. R. Miller, electrical and maintenance engineer, succeeds Mr. Masline as general superintendent.

GLENN R. EVANS, who has been made production manager of the Waukesha Motor Co., joined the company in 1929, and has had more than 20 years of manufacturing experience with Fairbanks-Morse, Beloit Iron Works, J. I. Case T. M. Co. and the General Refrigerating Co. He has also served as a private consultant in industrial efficiency, shop practice, and material handling. He has held many positions with the Waukesha organization since 1929 and latterly has had supervision of stores and material distribution and dispatch.

V. N. KRIVOBOK, authority on stainless steel and former professor of metallurgy at the Carnegie Institute of Technology, has joined the development and research division of The International Nickel Co. at New York to develop markets for alloy and stainless steels and assist steel manufacturers in expanding postwar markets. Until recently he has been chief metallurgist of the Lockheed Aircraft Corp. Before joining Lockheed in January, 1941, he had been professor of metallurgy at Carnegie Institute of Technology while also serving as associate director of re-

Old Friend of the Outfit

ling a jeep out of a submerged
l hole while under enemy fire
es plenty of you-know-what.
e, it's only one of hundreds of
s an invasion force may be called
n to do. And, it's just one of
es of ways in which good, de-
dable wire rope comes in mighty
dy.

On the far-flung battlefronts—
at home, too—men of action
w that even under the most ad-
se conditions they can count on
performance of Wickwire Rope.
ight now we are making more
e than ever before—but it has more jobs to do in more places. It's smart to take good care of the rope you now have so it will last longer and so our fighting forces can have more for *their* work.

Proper selection, application and usage of wire rope will make it pay dividends in longer life and higher production. Write for a copy of our free book "Know Your Ropes." And, if you have a wire rope question, we'll be happy to be of service. Write Wickwire Spencer Steel Company, 500 Fifth Ave., New York 18, N.Y.

HOW TO CONSERVE WIRE ROPE

Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 40 wire rope life savers, 20 diagrams, tables, graphs and charts.

SEND FOR YOUR FREE COPY

Send your wire rope questions to:

WICKWIRE SPENCER STEEL COMPANY

500 FIFTH AVENUE, NEW YORK 18, N. Y.

ne • Buffalo • Chattanooga • Chicago • Detroit • Houston • Los Angeles • Philadelphia • San Francisco • Tulsa • Worcester

For . . . . . Big Jobs . in . . . . . CHICAGO . . they . . . . . use . . . . . .

SPARLING MAIN-LINE METERS

TO SUPPLY 1 1/3 billion gallons a day, Chicago draws water through cribs like these in Lake Michigan. Measurement and chlorination are controlled by open-flow Sparling Meters. We are now supplying three more Big ones for the new South Filtration Plant.

Consistent Accuracy

Whether the Sparling Main-Line Meter is for a 2-inch flow or for a 16-footer, consistent accuracy is assured, for all Sparling Meters operate on the same Direct Action principle—the Totalizer geared to a propeller revolving in the flow. Recorders, Indicators and Controls may be added as desired. Bulletin 308 comes on request to tell the story in full.

The SPARLING

Manufacturer of Water Measuring Equipment

LOS ANGELES 54..Box 3277 Terminal Annex
CHICAGO 16.....3104 South Michigan Ave.
622 Broadway.....CINCINNATI 2
101 Park Avenue.....NEW YORK 17
BOSTON 8.....6 Beacon Street

TRACK HAULAGE IS CHEAPER HAULAGE

PLYMOUTH LOCOMOTIVES

• FROM 2½ TO 70 TONS •

PLYMOUTH LOCOMOTIVE WORKS

Division of The Fate-Root-Heath Co., PLYMOUTH, OHIO, U. S. A.

search for the Alleghen Ludlum S Corp.

CLARENCE S. TAY, wh formerly branch manager in cha e of the C cago factory branch o The Cro Corp., has been transfe d to the m office in Cincinnati, to be automo product manager.

The corporation recent discontin its Chicago branch at 151 South M igan Ave., and transferred the dis bution of its products in Chicago its territory to Harry Alter & Broth at 1728 Souh Michigan Ave.

CARNEGIE-ILLINOIS STEEL CORP. organized a production planning dep ment with John A. Hagan, of You town, as general manager. The dep ment will be under the direction D. F. Austin, Carnegie-Illinois v president. James M. Moorehouse be assistant general manager and H bert F. Byrne assistant to the gen manager.

RAYMOND E. BLOYE has been pointed superintendent of the Milwau Works, International Harvester succeeding V. A. Guebard. Me Felber, second assistant superinten will succeed Bloye as superintende

HARNISCHFEGER CORP., Milwau Wis., has appointed Frank J. Hi manager of the St. Louis district at 4030 Chouteau Ave. Mr. Herner will be in charge of sales and service for electric overhead traveling cranes and hoists, A.C. and D.C. welders and welding electrodes, welding positioners, and gasoline, die and electric-powered shovels, cra cranes, draglines, clamshells, etc. ner's experience includes engine and sales at the company's plants field offices. One-time assistant mana of the welding division, he was recently in the Chicago branch as cialist on welding airhardening s for armored fighting equipment.

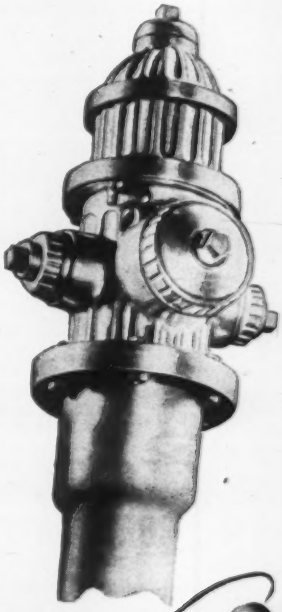
H. S. CHAFEE, treasurer of Bui Iron Foundry, Providence, R. I. L. E. Harper, president of Omega chine Co. of Kansas City, Mo. anno a consolidation whereby the latter comes a wholly owned subsidiary. Harper continues as president and rector of Omega and the company continue at 3409 East 18th S Kansas City.

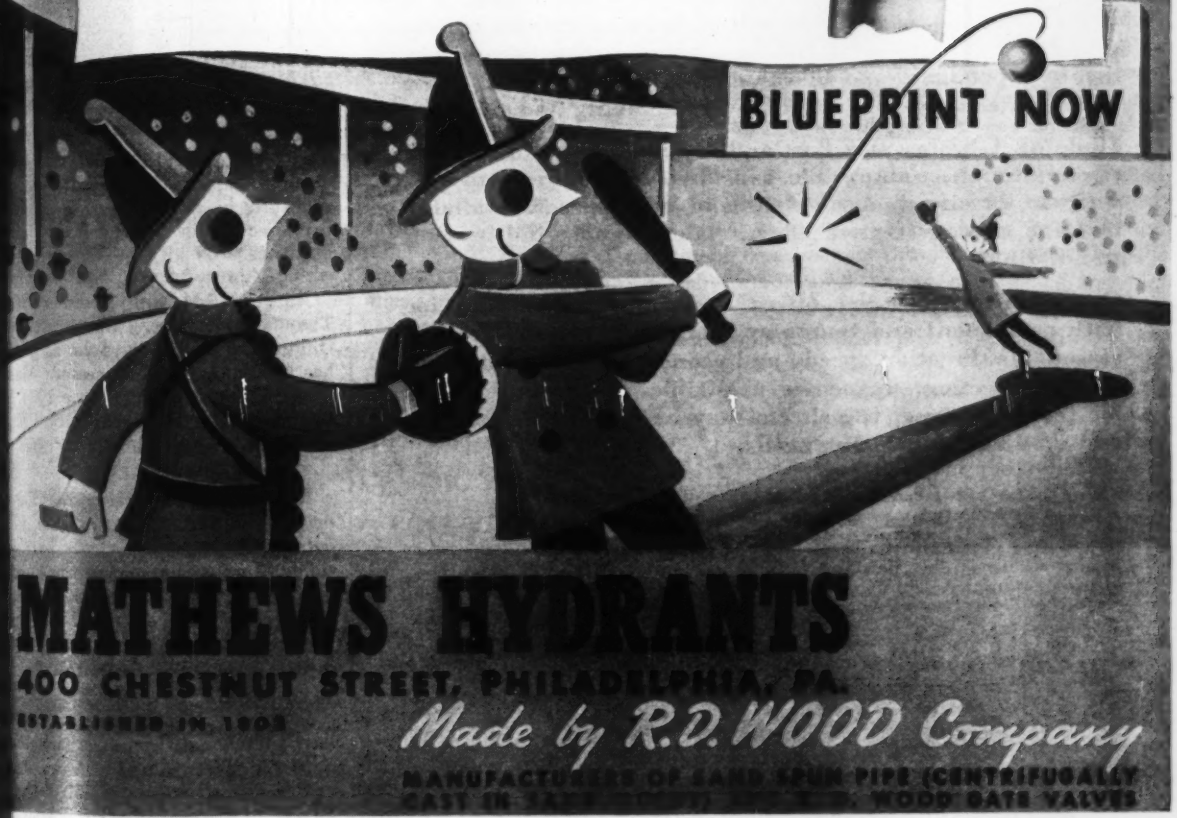
C. A. YOUNG has been appo

GET IN THERE AND START PITCHING

Team-work on the part of local planning and governing bodies is NEEDED NOW. You'll be asked to go to bat, one of these days, to provide much-needed work for the boys when they return. Millions of dollars of deferred water and sewage works maintenance, rehabilitation, expansion, and other needed local public works must be in contract-form... READY FOR IMMEDIATE ACTION. Don't get caught off-base by red-tape delays that can be avoided with a little team-work now.

We join the Committee on Water and Sewage Works Development in urging you, for the welfare of your community and the Nation at large, to determine tomorrow's needs, and to BLUEPRINT NOW!





MATHEWS HYDRANTS

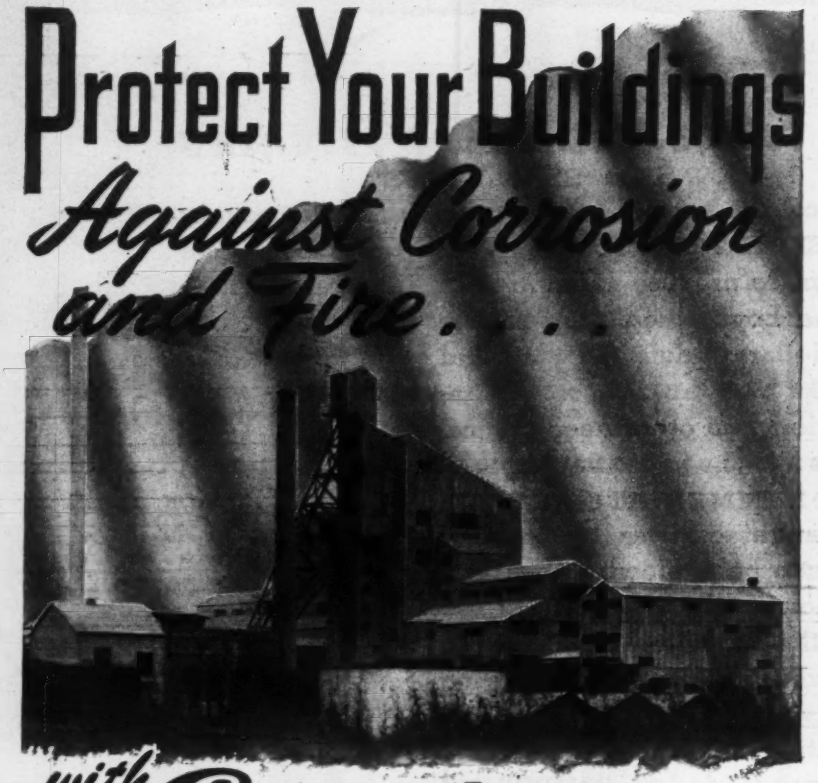
400 CHESTNUT STREET, PHILADELPHIA, PA.

ESTABLISHED IN 1903

Made by R.D. WOOD Company

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND) ... R. D. WOOD GATE VALVES

Protect Your Buildings *Against Corrosion and Fire . . .*



with **Careystone**
CORRUGATED SIDING AND ROOFING

If your plant is located where harmful atmospheric conditions are present—or if fire is a serious threat—you can insure dependable and permanent protection, with minimum upkeep, by applying Careystone Siding and Roofing.

Made of Asbestos and Portland Cement, this material is strong, tough, unburnable as stone. Not subject to rot, wear or termite damage. Acid and alkali-proof. Available in large sheets, it gives added rigidity and wind-bracing to building.

Careystone Corrugated offers important advantages for both permanent and temporary construction. First cost is reasonable. Erection speedy and economical. It requires no paint protection; upkeep is negligible. If the building is for temporary use, the sheets may be dismantled, stored, and used again for other needs.

The many economic advantages of Careystone Corrugated warrant your fullest investigation. Write for complete details. Address Dept. 30.

Shown above is the plant of Jefferson Island Salt Mining Company, Jefferson Island, Louisiana—protected by Careystone Corrugated Siding and Roofing.

THE PHILIP CAREY MFG. COMPANY
Dependable Products Since 1873
LOCKLAND, CINCINNATI, OHIO

In Canada: **The Philip Carey Company, Ltd.**
Office and Factory: **Lennoxville, P. Q.**

manager sales, hot rolle products d sion, Sheffield Steel Cor Kansas C Mo. Mr. Young has bee with She ten years. Since 1937, h was mana of the district office, Ch ago. He i civil engineer graduate Purdue U versity. His experience has been in sign, promotion and sale f material reinforced concrete and structural st construction.

THE NOVO ENGINE Co., Lansi Mich., has appointed Dean K. Mitch sales manager, replacing R. B. Har resigned.

Mr. Mitchell joined Novo in 193 manager of export sales. Prior to t he was with the Niagara Sprayer Chemical Co., Inc., Middleport, N. where he went shortly after being m tered out of the 35th Aero Squadr U. S. Army, in 1919. As export man ger, Mr. Mitchell made two trips Mexico, and in 1939 made a surv of Novo distributors in the West Indi South and Central America.

ALEXANDER M. HAMILTON has b appointed vice president, foreign sa of American Locomotive Co. Mr. Hamilton held foreign sales positions with the company, serving as European representative in Paris after the armistice until 1921. He is executive vice president of Montreal Locomotive Works, Ltd., Ca dian subsidiary of American Lo motive Co. In 1915 he went to Rus as the company's representative. S sequently he was in charge of loco tive erection in various other fore countries.

Blackstone Stud

RALPH H. MAXON, president of Tyson Roller Bearing Corp., Massill Ohio, has resigned, and John K. Colg has been elected his successor. Max who has been president since 1934, w remain in an advisory capacity. Colg has been vice-president and treasur

ROBERT R. ZISETTE, general sa manager of SKF Industries, Inc., Phi delphia manufacturers of ball a roller bearings, announces the appoi ment of Walter C. Ahlers at Detr manager to succeed Robert H. Hirs resigned. Mr. Ahlers has been assist district manager of the Detroit office.

JOSEPH T. RYERSON & SON, In have purchased from the Bethleh Steel Co. its Pittsburgh steel ware at Carnegie a building of 150,000 sq. on a site of several acres. It is equip

y municipalities throughout the country are making post-war plans for improvements or itions in their water systems. STREAMLINE cop- pipe connected with STREAMLINE solder type fit- s provides the most practical installation for water ice lines . . . for all general plumbing and heating poses, and for many applications in filtration plants.

d together, STREAMLINE copper pipe and STREAMLINE der fittings are an unbeatable pair.

EAMLINE copper pipe when assembled in the STREAMLINE ng rests upon an internal shoulder of practically the same ght as the thickness of the pipe wall, thus forming a continu- y smooth waterway which offers no anchorage points for the ding up of foreign matter in the water.

VIBRATION PROOF

EAMLINE copper pipe connected with STREAMLINE solder fittings is from the harmful effects of vibration. Vibration is not localized at the s as it is with threaded or flared fittings, but is harmlessly dissipated ughout the service line.

SETTLEMENT AND FROST ACTION

EAMLINE copper service pipe is so ductile that it will stretch enough to easily care of any settlement of filled earth, or, in fact, anything that might impose a strain on the service line which would cause failure of rigid ferrous pipe or, at the very least, cause leakage at the threaded connections.

In the Northern States and in the Dominion of Canada, copper service pipe of our manufacture has an outstanding advantage that places it far in advance of any other service material. This advantage is its resistance to frost action. This service pipe containing water under almost any range of pressure used in water service work can be alternately frozen and thawed out for a considerable number of times without showing any effect except a slight increase in diameter.

INVESTMENT INSURANCE

STREAMLINE copper pipe and fittings are at present being used 100% for war purposes in naval craft of practically all kinds, but it is not too early to plan again for their peacetime use. Waterworks officials who are responsible for the return on a heavy capital investment will find STREAMLINE materials one of the lowest cost forms of insurance that they can adopt.

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

Above job pre-drained by STANG Wellpoints. Subgrade 10′ deep. Work was done in congested area, where banks could not slope, so bracing was used for support. Note Wellpoints outside line of excavator; also thoroughly dry condition of area being excavated.

HIS JOB WAS

STANG-DRIED!

—and Pipe installation jumped

from 50′ to 450′ per day

This sewer job had previously been in operation without well-points. Excavation crawled—until STANG stepped in! Then things speeded! The 10′ deep subgrade and congested conditions proved no difficulty. STANG installed Well-points, leaving the excavator in the clear . . . the result you see. Large jobs or small, STANG dries them all—fast, at low cost, SPEEDS work. We do a complete job; test soil, plan, install, supervise. Don't let your job be a nightmare. Wake up—use STANG! *Consult nearest representative.*

JOHN W. STANG CORP.

TWO BROADWAY • NEW YORK 4 • N. Y.

HOUSTON 3, TEXAS	PORTLAND 5, ORE.	LOS ANGELES 13, CAL.
2312 Calhoun Street	1003 Terminal Sales Bldg.	816 West 5th Street

with cranes. Ryerson h... opened a ... office, at 330 Grant St... Pittsburgh.

Included in the purc...ase is the B... lehem stock of bars, sh...pes, plates ... sheets. Ryerson plans ... augment ... stock and plant, maki... available ... line of steel products ...rovided by ... ten other Ryerson plan...

JOSEPH DUFFY has ...een appoi... sales manager of the ...rving Sub... Grating Co., Long Island City, N. Y. He will direct sales in every state. Irving has developed emergency airplane landing mats for battle-fronts, and armored floors for industrial plants. It now is experimenting with a steel grating highway ... landing mats for rooftops for post-helicopters.

Mr. Duffy from 1920 to 1928 w... salesman for the Meneely Bell Co... Troy, N. Y. He sold the most ... set of bells ever made in the U... States, known as the Deeds Car... to the National Cash Register Co.... Dayton, O.

JOHN A. MCCONE, former exec... vice-president, has become presid... The California Shipbuilding C... Wilmington, Calif., succeeding S... Bechtel, now chairman of the boa... directors. Jerome K. Doolan, ge... manager, has succeeded McCone.

COCHRANE CORP. of Philadelphia ... acquired exclusive sales rights to ... rotameters manufactured and hit... sold by Rotameters, Inc., of Jenkint... Pa. Cochrane has manufactured ... sold a recording area type meter ... years and the addition of the rota... rounds out the line.

No change will be made in the ... sonnel of the companies, William ... Bennett being manager of Cochra...

The Rud-o-Matic Tagline is operated on a spring principle and maintains at all times a positive tension sufficient to steady a clam shell bucket under any and all conditions, and will operate perfectly with the boom at any angle. It eliminates all the grief usually encountered with the average tagline as there are no weights, tracks, pins, carriages, or sheaves to wear out or to get out of order. Because of the large bearing and fewer sheaves, the saving on cable alone would eventually pay for it.

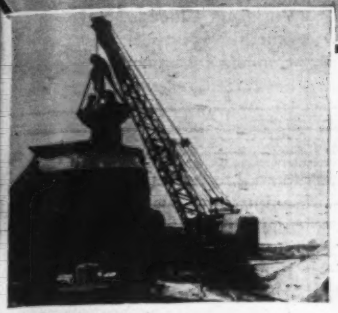
Tagline is complete with fair lead and cable attached and can be installed in less than one-half hour. Most of the crane manufacturers have adopted the Rud-o-Matic as standard equipment.

McCAFFREY-RUDDOCK TAGLINE CORP.

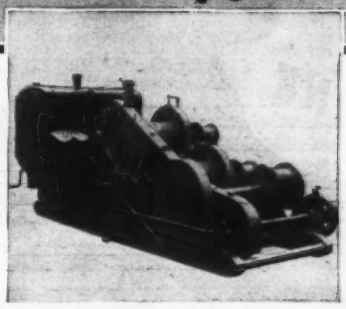
2121 E. 25TH ST. LOS ANGELES 11, CALIF.

TRACTOR & MCHRY. CO. Atlanta, Ga. | A. H. COX & CO. Seattle | FORSYTHE EQUIP. CO. Long Island City, L. I. | COMLEY EQUIP. CO. Philadelphia, Pa. | W. E. PHILLIPS Detroit, Mich. | L. L. HANSON Chicago, Ill. | OWEN BUCKET CO., LTD. Berkeley, Calif.

AMERICAN
MATERIALS HANDLING FOR EVERY INDUSTRY



ERICAN Locomotive Crane at aggregate plant.



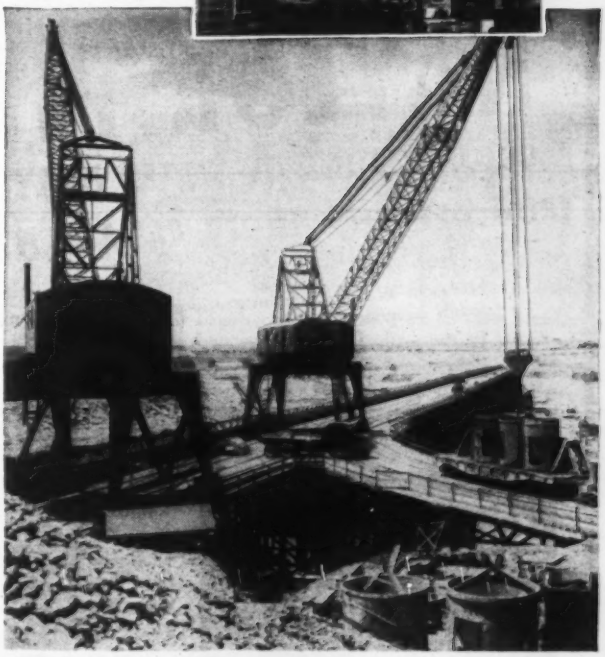
AMERICAN General Purpose Hoist.

AMERICAN Stiffleg Derrick.

AMERICAN REVOLVERS ON LARGE DAM CONSTRUCTION

The ideal materials handling method for any construction job is dictated to a great extent by the size and type of project. For many years now, dams and similarly large construction projects have proved the AMERICAN REVOLVER a natural for placing reinforcing steel, forms, pouring concrete, and stripping forms. For handling materials with hook, magnet or bucket, there is a choice in size, capacity and type of power to meet a variety of conditions.

Maybe, for your larger work the AMERICAN REVOLVER—a gantry mounted revolving crane—is the ideal materials handling method. Now is the time to look into it. Catalog 400-R-1B gives full particulars on application and construction features.



AMERICAN REVOLVERS doing a materials handling job at dam project.

4413

Plan now . . . but wait for **AMERICAN!**

AMERICAN **MATERIALS HANDLING** *for* **EVERY INDUSTRY**

AMERICAN HOIST & DERRICK CO.

Saint Paul 1, Minnesota

CHICAGO SAN FRANCISCO NEW YORK

Wherever wire rope is fastened . . . . use genuine **CROSBY CLIPS** *with the Red-U-Bolt*

NAYLOR PIPE GULPS 2,000,000 TONS OF WATER DAILY TO UNCOVER IRON DEPOSITS UNDER CANADIAN LAKE

Here's a dramatic demonstration of light-weight pipe performance on a tough assignment.

In the project of de-watering Steep Rock Lake, more than a mile of large diameter Naylor Lockseam Spiralweld Pipe is literally carrying away the lake at the rate of 7 inches a day. In all, this distinctive light-weight pipe must handle 121 billion gallons of water before the deposits of iron ore can be tapped.

Naylor's exclusive structural advantages enable this light-weight pipe to make light work of gulping 2 million tons of water a day.

That's why Naylor is specified for such services as dredging, hydraulic sluicing, de-watering, ventilating, exhaust and intake and other applications of high and low pressure air and water lines.

Only NAYLOR PIPE Combines All These Advantages

- Always accurate in diameter.
- Concentric ends match correctly.
- Easier to install.
- Holds true cylindrical form.
- Stays tight and leakproof.
- Stronger—safer.
- Handles jobs normally requiring heavier-wall pipe.
- High salvage value.
- Light weight saves steel.
- Cuts maintenance costs.
- Saves money.

Sizes: 4" to 30" in diameter—all types of fittings, connections and fabrications.

Naylor

NAYLOR PIPE COMPANY

1248 East 92nd St. • Chicago 19, Illinois

appliance division, wi[th] W. W. [T]
in charge of sales an[d] William [M]
in charge of engine[er]ing, while
Rotameters, Inc., J. E[.] Vandegrift
cently appointed gen[er]al manage
associated with Alfre[d] Elsasser,
nical director, Robert [C.] Wolf,
engineer, Reynold Wil[so]n and J[.]
Madden, glass technol[o]gists, and E[.]
ard Forepaugh, office [m]anager.

THE RICHKRAFT Co[.] in the Bu[ild]
Building, Chicago, and with an ea[st]
office in Westport,
Conn., has been
organized recently
to market rein-
forced building
paper, curing com-
pound, reflecting
paint, joint sealer,
and kindred prod-
ucts for construc-
tion.

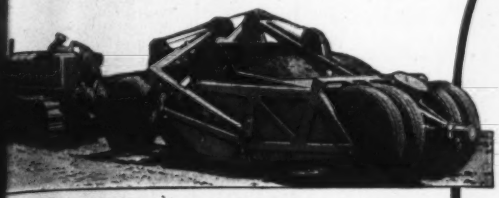
Senior partner
and general manager is Frankl[in]
Richards, who was with Sisalkraft
for fifteen years. Mr. Richards'
of converting rolls of paper into
sized blankets is said to have re[vo]
tionized the use of paper for prote[c]
purposes on highways, airport
other construction. E. M. Reyn[o]
formerly eastern sales manager
Sisalkraft, is junior partner and ea[st]
manager. H. H. Deputy, handling s[a]
is a general partner, as is Gra[ce]
Shaunessy, in charge of inside wor[k]

A. W. DALE of the Gardner-De[n]
Co., has been appointed assistan[t]
Vice President R. H. Pearson.
Dale has been managing directo[r]
South African operations for 12 y[r]
This company is known as the Gar[d]
Denver Africa (Proprietary) Lim[i]
He will be succeeded in South A[f]
by Paul Lagerquist, who recently r[e]
sented Gardner-Denver in Australi[a]

A CHANGE in the sales policy of R[.]
LeTourneau, Inc., providing for e[x]
sive representation of its line of h[e]
earth-moving equipment by its own
tributors throughout the world in[-]
of through Caterpillar Tractor
dealers has been announced. Com[-]
officials believe this will promote
development of a rubber-tired p[u]
mover which has put both the LeT[-]
neau company and "Caterpillar" d[-]
ers representing LeTourneau into
rect competition with the track[-]
tractor. Through the new plan, LeT[-]
neau feels that competition which m[-]
possibly have unfavorable results
be avoided.

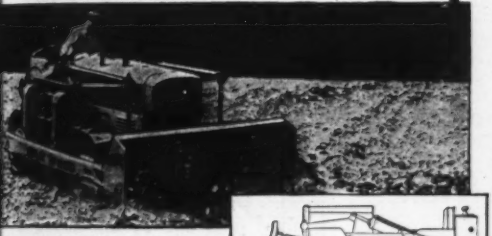
THE OPENING of another Pacific C[o]
factory branch office has been
nounced by the Cooper-Bessemer C[o]

4-wheel hydraulically operated Scrapers for th moving, specifically constructed for fast digging, y loading, accurate spreading.

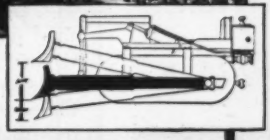


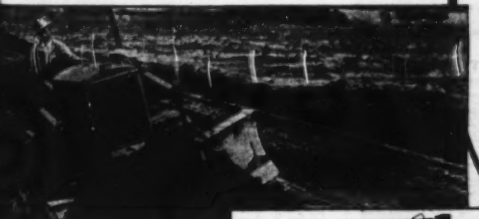
4-wheel cable operated Scrapers for earth mov- provide less power to load; greater clearance; ibility for fast hauls; positive rolling ejection; pre- on spreading.

2-wheel hydraulic Scrapers for low-cost, earth ing—dig, load, haul, back dump, make short turns.

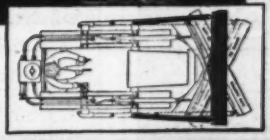


Bulldozer: Blade fixed pushing loads ahead.





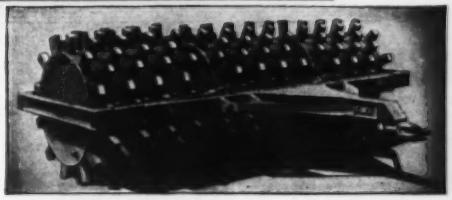
Roadbuilders: Blade set push loads ahead, side- loads to left or right.



GAR WOOD Road Machinery

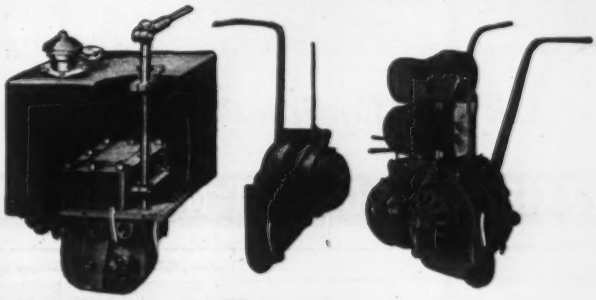
Gar Wood Industries, Inc., manufactures a complete line of heavy-duty, earth-moving machinery: two-wheel Hydraulic Scrapers in 3, 5, 6, and 8 cubic-yard capacities; four-wheel Hydraulic Scrapers in 8, 10, and 15 cubic-yard capacities; four-wheel Cable Scrapers in 11, 15, 20, and 25 cubic-yard capacities; Bulldozers; Roadbuilders; Tamping Rollers; Rippers. Accepted by leading contractors and governmental agencies throughout the world, as meeting all requirements for heavy earth-moving equipment.

Refer to picture number when ordering literature



2F Rippers rip compacted earth, shale, rock, roots, old pavements, old roads.

2G Sheep-foot Tamping Rollers built with interchangeable drums (single, double, triple).



2H Hydraulic Control Unit

2J Cable Control Single Drum.

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Hydraulic and Cable Control Units for operation of Scrapers, Bulldozers, Roadbuilders, Rippers, for heavy-duty service with track-type tractors.

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LOWELL F. WHISLER has been el manager of purchases and expe for the Waukesha, Wis., Motor Co. Mr. Whisler supervised service operations with the Haynes Automobile Co. from 1916 to 1920—with a brief interlude in World War I in the U. S. Navy. As both production and factory manager for the In Truck Co. from 1920 until he j Waukesha, he made a good reco meeting schedules and improving ufacturing. He made his present nection in 1937 as liaison between kesha's factory production and se departments. His other posts in supervision of stores, material ex ing and the management of prod office system and records.

THE CLEVELAND PNEUMATIC TOO and its Rock Drill Division, the C land Rock Drill Co., Cleveland, announce the appointment of R Craig as export manager. Mr. has been with the company several and is their former district mana Salt Lake City, Utah. In 1920 he chief engineer of the Cerro de P Copper Corp. in Peru. Later he drills in the nitrate fields of nor Chile, and is credited with introd rock drills in the nitrate industry.

Mr. Craig has since sold rock in many of the countries of Latin A ica, and recently made a 25,000 trip through South America.

A. F. RUCKS has been elected dent and general manager of the Tagliabue Manufacturing Co., suc ing the late C. D. Waters. Mr. Ruck been with the company over thirty holding important positions. The pany makes thermometers, oil te instruments, potentiometers, mo testers and instruments for reco and controlling temperature and sure. The name Tagliabue has identified with the manufactur thermometers and instruments c ously since 1769, said to be a rec long service few companies can

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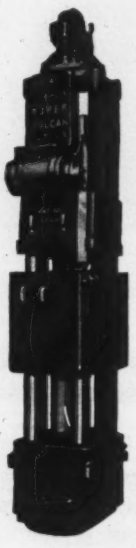

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Tire Repair Equipment—A wartime catalog offers tire and tube repair equipment. Vulcanizing repairs for both natural and synthetic rubber are now available for civilian use.—*J. W. Speaker Corp., 3059 No. Weil St., Milwaukee 12, Wis.*

Compressors—This catalog illustrates in complete detail a compressor in various mountings for construction, railroads, and small industrial installations.—*Schramm, Inc., West Chester, Pa.*

Postwar Planning Handbook—As an aid in enlisting public support for the postwar highway plan of the American Road Builders' Association, a speakers' handbook has been printed for those willing to engage in the campaign. It contains suggestions and a comprehensive arrangement of useful facts.—*American Road Builders Association, 1319 F Street, N. W., Washington 4, D. C.*

Calcium Chloride—A dozen or more circulars on various uses of calcium chloride are available.—*Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Mich.*

Pneumatic Controller—A bulletin tells how in applications where temperature, pressure, rate of flow or liquid level must automatically conform to changes in another variable related to the same process, this manufacturer's apparatus offers a responsive control which reduces the adverse effects of time lag and load change. The bulletin is liberally illustrated with photographs and simplified application drawings.—*Taylor Instrument Companies, Rochester, N. Y.*

Blasting Cartridge—A booklet illustrates the advantages of using a cart-

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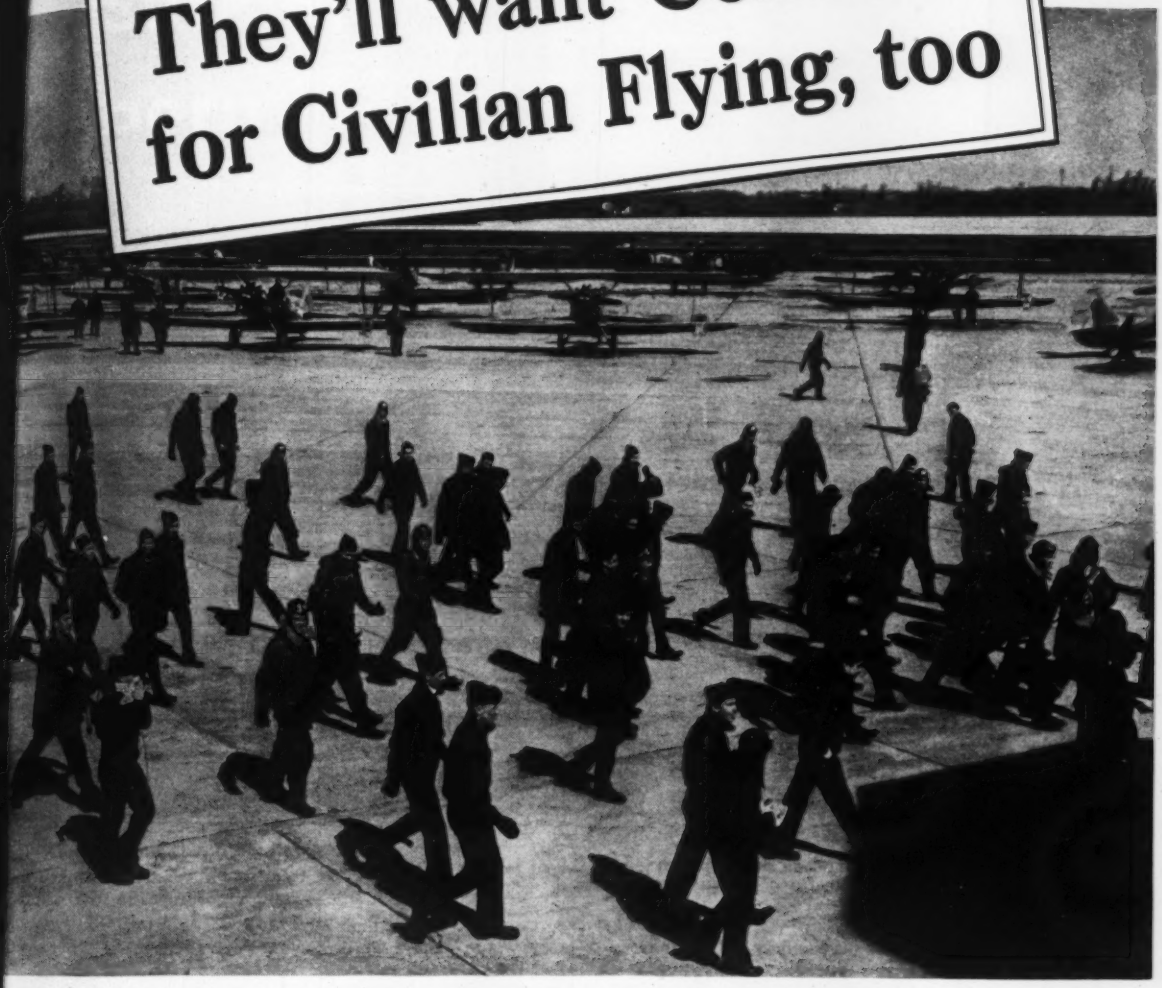

Cadets on the line at Naval Air Station, Glenview, Ill. (*Official U. S. Navy photograph.*)

hen the war is won many flyers trained on crete paved airports will fly civilian trans- t planes, operate civilian airports and run country's expanded air transportation tem.

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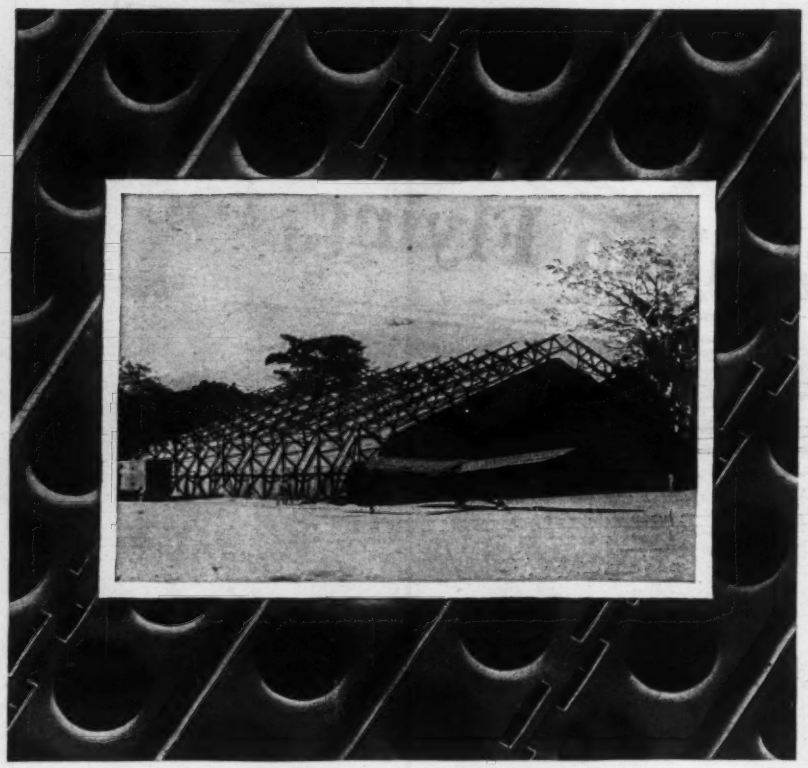

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Industrial Wire Ropes—This 96-... book aids the selection of the right ... for the job. It illustrates rope con... tions, working loads, stresses, ... and drum sizes, and has a catalog ... tion of industrial wire ropes.—... *erick & Bascom Rope Co., 4203 ... Union Blvd., St. Louis 15, Mo.*

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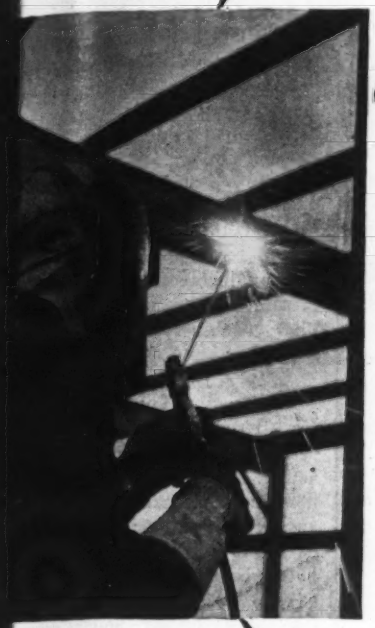

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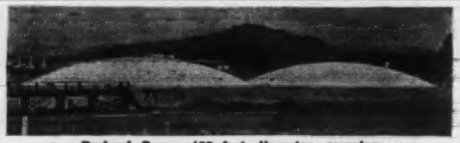

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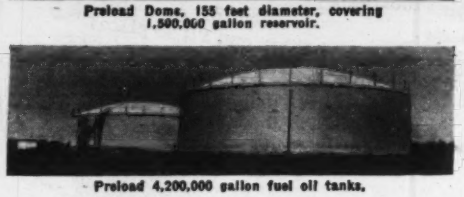

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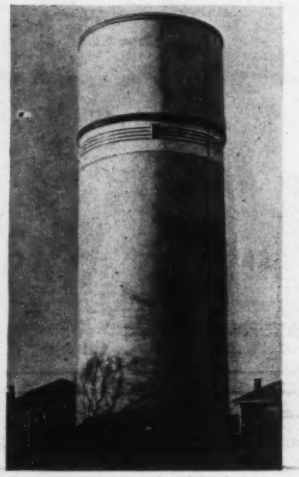

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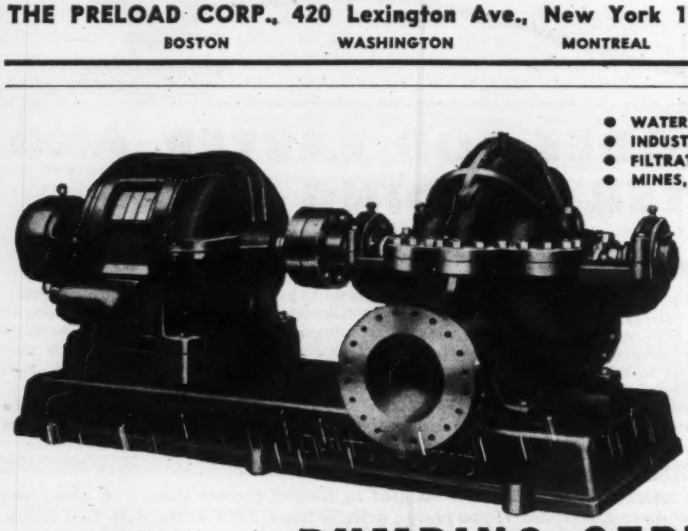

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ore food is needed, and there are fewer hands to oduce it. Bigger crops from better soil is the swer, and aglime producers by the hundreds are sponding with unprecedented tonnages of soil eetener.

Typical of the many agricultural limestone plants ipped with Universal steel plate roller bearing lverizers and other profit-proved Universal equip-nt are those pictured.

Representative of what Universal-equipped plants doing for their owners and for the good of the ntry is the plant of A. R. Alvis, West Plains, ssouri, which is shown above averaging 250 tons aglime per 8-hour day with fuel cost, including quarry trucks and two 105′ air compressors for ls, approximating $18.08. Plant consists of apron der, 18″ x 24″ Universal Roller Bearing Primary Crusher set for 2″ opening, 4′ x 12′ 2-deck rating screen and hopper, Universal No. 3 Pulver-r and Rotovator and conveyors. This operator has tracts for 35,000 tons this season and is doing a siderable daily cash business besides.

When postwar road building and repairs "get the en light," it will only be necessary to change the eens and the manganese steel grates to produce to 1½" material.

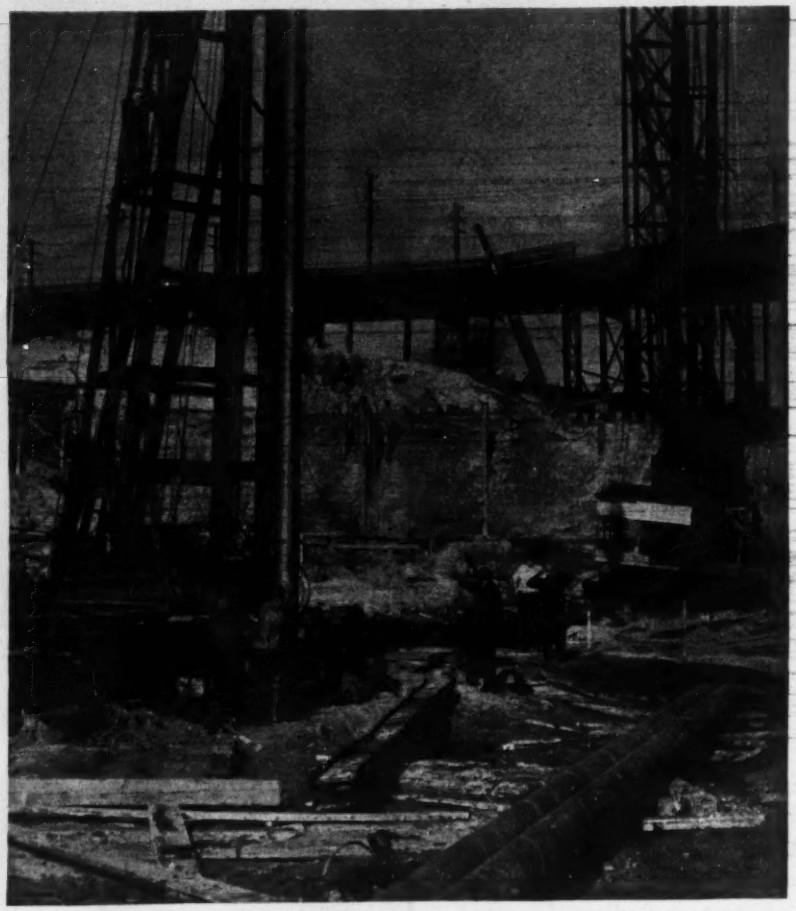
NIVERSAL ENGINEERING CORP.
C Ave. W, Cedar Rapids, Iowa

Trankle Bros., Waterloo, Illinois, Universal stationary aglime plant averages 90 to 100 tons daily.

Pine Hill Lime & Stone Co., Pine Hill, Ky., keeps production up with Universal hammer mill.

Universal engineers stand ready to help in converting your plant to aglime production and to assist in reconversion to road rock or aggregates after the war. Universal standard "packaged" units practically shipped from stock, keep the change-over and the operating costs low. Send for literature.

This job was speeded by using 90-foot lengths of ARMCO Spiral Welded Piles.



THESE STRAIGHT-DRIVING PILES
save time and steel

You can speed your foundation jobs and help save vital steel by using ARMCO Spiral Welded Piles. They *drive straight* with the least time and effort.

The tough spiral weld imparts extra lateral stiffness and high collapse resistance to even the longest lengths. Yet ARMCO Piles are relatively light in weight for quick, easy handling and hauling. Long lengths also save driving time. You can get ARMCO Foundation Piles in any lengths that can be handled and shipped.

For greatest economy specify the exact wall thickness you need in any diameter. Diameters range from 6 to 36 inches; wall thicknesses from 3/16 to 1/2-inch. When you need cone points, end plates or cutting shoes, these can be mill attached. For shipping dates write to The American Rolling Mill Company, Pipe Sales Division, 1141 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

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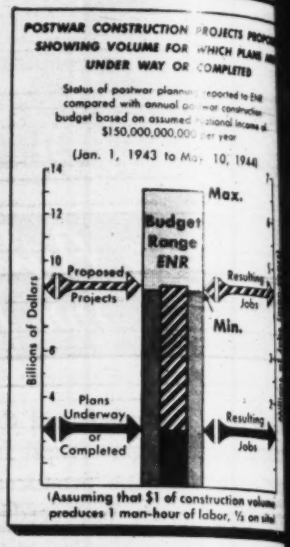
SPIRAL WELDED
Foundation Piles

Water Supply Lines • Caissons • Line Pipe • Prefabricated Pipe • Dredge Pipe • Industrial Pipe

POSTWAR PROJECT



Projects proposed for postwar construction been published in these columns since Ja 1943, as they have been reported to Engine News-Record.

The chart above shows, both in estimated lar volume and in jobs or man-years of l how fast this reservoir of future work is fillin

If you or your community are workin projects that have not yet been included in "postwar reservoir," please send us an i list and description of them, including estim cost and the names of the engineers who at work on the plans. Then as you watch arrows climb you will know that you and community are contributing to the success o NUMBER ONE JOB of preparing for peac

Address your projects list to Manager, ness News Department, Engineering N Record, 330 W. 42nd St., New York 18, N.

MINIMUM SIZE OF PROJECTS PUBLISH

Public Works	$2
Industrial Buildings	
All Other Buildings	$

WATER SUPPLY

★ **Colo., Greeley**—City, long-range w sys. exten. $1,797,120. Black & Ve 1406 Bway., Kansas City, Mo., consult. e

Mass., Billerica—Town, Bd. Select Town Hall, storage facilities for addi m.g. $45,000. S. M. Ellsworth, 6 Be St., Boston, engr.

★ **Mo., Kansas City**—City Water Dpt., prv. water distr. sys., incl. imprv. boo pump. station, 91,200 ft. 16-to 42-in. trunk mains. $1,983,000. Burns & Mc nell Eng. Co., engrs., 107 W. Linwood B completed improvement report.

N. J., Harrison—Town, water distr. $457,000.

N. M., Las Vegas—Town, impr., W sewers, etc. $50,000. Bonds voted.

N. Y., Ossining—Town, watermain placement, exten. $87,700. State Aid Pl ning Funds allotted.

N. Y., Savannah—Town, water supply addn. $18,400. State Aid Planning Fu allotted.

Pa., Harrisburg—City, H. E. Mill mayor, Municipal Bldg., imprv. water d sys. $50,000. R. M. Andrews, Munic Bldg., city engr.

R. I., North Kingstown—Town W Comrs., R. W. Rodman, chn., North Kin town, brick pump. station addn., incl. w shop, residential rooms and storage ro $16,000.

S. D., Eureka—City, H. W. Weber, c City Hall, W.W. sys. $25,000. E. Heil city engr. CD 7/15—ENR 7/17.

S. D., Sioux Falls—City, J. S. Nic water comr., imprv. water sys., incl. w softening plant and high stage centrif pump. $281,720. Burns & McDonnell, W. Linwood Blvd., Kansas City, Mo. CD 8/20—ENR 8/26.

★ **Tex., Austin**—Town, water line exte replacements. $550,000.

Tex., Austin—Town, filtration plant, $2 000; pump. plant, $150,000.

Tex., El Paso—City, earth and conc reservoir, $100,000.

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